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ABSTRACT

Described is the evaluation of the pilot-test version of the Measurement of Length Unit, part of an instructional program developed by the Vocabulary Development Project, with 80 educable or trainable mentally handicapped primary grade children in either special classes within regular schools or in special schools. Feedback for the formative evaluation stage came from results of pretesting and posttesting, written evaluations of lessons by teachers, and classroom observations. Results are presented for each of the eight lessons in terms of objectives, performance of classes from neighborhood or special schools, and an interpretation. Summarized are comments from the teacher review board meeting. Results are discussed in terms of need for instruction, instructional effectiveness, design of the materials, content, sequencing, and test instruments. Results are seen to support the need for measurement instruction, with major changes being made in the sequencing of instruction and revision of the test. Appended are a description of the pilot-test version of the length unit, the pilot-test questions, a sample evaluation form, classroom observation forms, a description of the revised version of the measurement of length unit, and the revised length unit test. (DB)

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MEASUREMENT OF LENGTH UNIT: A FORMATIVE EVALUATION¹

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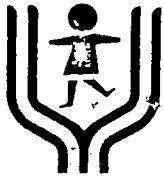
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RESEARCH, DEVELOPMENT AND DEMONSTRATION CENTER IN EDUCATION OF HANDICAPPED CHILDREN

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The University of Minnesota Research, Development and Demonstration Center in Education of Handicapped Children has been established to concentrate on intervention strategies and materials which develop and improve language and communication skills in young handicapped children.

The long term objective of the Center is to improve the language and communication abilities of handicapped children by means of identification of linguistically and potentially linguistically handicapped children, development and evaluation of intervention strategies with young handicapped children and dissemination of findings and products of benefit to young handicapped children.

MEASUREMENT OF LENGTH UNIT: A FORMATIVE EVALUATION¹

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The Measurement of Length Unit is one of the five instructional units of the Money, Measurement and Time Program (Thurlow, Taylor, & Turnure, 1973) produced by the Vocabulary Development Project. Like the other units in the Program, the Measurement of Length Unit was developed jointly by educational practitioners and educational researchers. Through the development of both vocabulary and skills, the Unit attempts to provide educationally handicapped children with an understanding of length and its measurement. Initially, a pilot-test version of the Measurement of Length Unit was produced and subjected to extensive evaluation. The purpose of the evaluation was to provide information for the revision of the unit into a form which would be most effective for the child and most useable by the teacher.

This paper is a description of the evaluation of the pilot-test version of the Measurement of Length Unit. In the Project's four-stage overall evaluation design (Krus, Thurlow, Turnure, Taylor, & Howe, 1974), this evaluation represented Stage Three, and was referred to as the "formative" evaluation of the Measurement of Length Unit. The major purpose of the formative evaluation was to provide a systematic basis for the revision of the Length Unit. The formative evaluation represented the assessment of the product during

the process of its development and involved the evaluation of its effectiveness and useability in the classroom, feedback to the developers, and subsequent changes in the materials based upon the feedback information. Data obtained during this formative evaluation are included here, with a description of the resultant changes in the Measurement of Length Unit.

Background of the Measurement of Length Unit

A needs assessment was conducted by searching available curriculum materials for teaching skills and vocabulary related to the measurement of length. During this search, special emphasis was placed on determining the availability of materials for educationally handicapped children. It was found that the materials available for teaching length were geared primarily for children of normal intelligence, or for children with entry level skills exceeding those of educable mentally retarded (EMR) children of elementary school age (e.g., reading and/or counting skills). Based upon the evident need for instruction for EMR children, the specific length-related needs of these children were assessed and organized into an instructional package consistent with an elaboration approach found to be successful with EMR children (Taylor, Thurlow, & Turnure, 1974). This phase of research to development was discussed by Thurlow, Taylor, and Turnure (1973).

Description of the Measurement of Length Unit

During the formative evaluation stage, the Measurement of Length Unit was divided into two levels of instruction: pre-

primary and primary. These levels corresponded to the "defined" school system grouping of EMR classrooms. The pre-primary instruction included 8 lessons, and the primary instruction included 9. The eight lessons in the pre-primary level presented the comparatives of height, length, and distance, and introduced the ruler and the foot unit of measurement.

The instruction in the primary level began by introducing the concept of measuring and by reviewing the beginning measurement concepts presented in the pre-primary level (i.e., ruler and foot). Instruction then progressing to the introduction of several additional units (e.g., inches, yards) and tools (e.g., yardstick, tape measure) of measurement. (See Appendix 1 for a list of the specific lessons in each level of instruction.)

The instructional materials in the Measurement of Length Unit included teacher's editions (pre-primary and primary), cassette tapes containing definitions and stories related to important length concepts (8 pre-primary; 6 primary), an individual book of pictures for each student to follow as the tape was presented, and numerous worksheets and transparencies to complete the instruction. A more complete description of the materials (and the underlying instructional techniques) used during the formative evaluation may be found in Taylor, Thurlow, and Turnure (1973).

Method

Subjects

Two pre-primary classes (N = 21) from "neighborhood" schools and two classes (N = 59) from "special" schools participated in

the formative evaluation of the pre-primary instruction. "Neighborhood" schools were ones which contained "regular" classes in addition to one or two "special" classes. Children in the special classes within these schools generally represented a higher functioning EMR population (i.e., those children whom it was hoped might be able to return to a "regular" class). "Special" schools were those which contained only classes for mentally retarded children. EMR children in these schools included the lower range of the population who, because of their lower functioning and associated problems, were considered less likely to return to a "regular" class. Of the two "special" school classes participating in the formative evaluation of the Length Unit, one was a class for trainable mentally retarded (TMR) children (School 3) and the other class was an EMR class (School 4).

Due to production delays, only the pre-primary instruction underwent complete formative evaluation. In addition, several first versions of lessons from the primary level were evaluated in one EMR class which had completed the pre-primary instruction. Findings from this evaluation were also discussed at the Teacher Review Board meeting so that revisions could be made in the primary level instruction.

The children from the "neighborhood" schools in this study had an age range of 6.9 to 9.7 years ($\bar{X} = 8.4$, $SD = 0.9$). IQ data were available for only one of the two classes (Range: 65-79, $\bar{X} = 73.3$, $SD = 4.6$). The EMR "special" school class had

an age range of 5.8 to 8.1 years ($\bar{X} = 7.0$, $SD = 1.1$) and an IQ range of 54 to 64 ($\bar{X} = 60.0$, $SD = 4.6$). The TMR "special" school class was older (approximately 10 - 18 years). IQ data were not available for these children.

Procedure

The formative evaluation design (Krus, Thurlow, Turnure, Taylor, & Howe, 1974) involved feeding back information from the pilot-test of the instructional materials to the developers for revision. The feedback information was obtained in a variety of ways.

First, extensive testing was done during the pilot-testing of the materials. Since the Length Unit attempted to avoid making assumptions about the children's ability levels, each objective was tested two or three different ways to insure accurate measurement (Bart, personal communication). Prior to instruction, students were given a pretest on the objectives. Posttesting of the same objectives was conducted after instruction. Also, since the materials incorporated the concept of the "growth of meaning" (i.e., more sophisticated aspects of a word's meaning were embedded in later lessons), numerous tests were given frequently during the instruction. These tests were used mainly to determine the immediate "worth" of the lessons (e.g., whether or not the objectives were met immediately after related instruction was presented). If 80 % mastery was not demonstrated on a given objective, it was then included in the next test to ascertain if later in-

struction affected performance. In addition, these tests frequently included questions related to objectives not yet taught. This was done in order to determine any "transfer" that instruction might have to performance on future objectives. (See Appendix 2 for a copy of test questions used.)

A Teacher Review Board made up of the teachers using the materials during the formative evaluation stage was another source of feedback for revision. Throughout the formative stage, teachers completed written evaluations of each lesson. (See Appendix 3 for a sample evaluation form.) Teachers also participated in a "Teacher Review Board" meeting when all instruction was completed. The Teacher Review Board meeting involved a four-hour discussion of all instruction, including sequencing, pictures, and any problems not covered by the evaluation forms.

Information from classroom observations was a third source of feedback for revision. Since the tape presentations were designed to build vocabulary skills, observations were made primarily on this part of the instruction. Special attention was given to the use of the materials by the teachers, and the response of the students to the tape presentations (e.g., whether or not they answered questions, pointed, etc.). (See Appendix 4 for a copy of the forms used for classroom observations.) Because of the quantity and subjective nature of the classroom observation data, these data have not been included in the results section of this paper. It should be noted, however, that the information obtained

through classroom observations was discussed at the Teacher Review Board meeting and implications for revisions are included within that summary.

Results

A summary of each of the sources of feedback for revision is included here. First, there is a lesson by lesson description of (1) the objectives tested, and (2) the information obtained from the teacher evaluation forms. The description of the objectives tested includes data from tests given prior to instruction ("Pre"), tests given during instruction ("Post Lesson"), and tests given following all instruction ("Post Unit"). In several cases, data from "normal" subjects of the same age as the "neighborhood" EMR children were obtained for comparison purposes.

Subjects in the "special" school classes did not receive instruction beyond Lesson 3, due largely to time restrictions. Data from these classes on the first three lessons are presented, in addition to data from selected objectives from lessons following Lesson 3.

The results section concludes with a summary of the information obtained at the Teacher Review Board meeting.

Formative Evaluation of Length Unit

Lesson 1	9
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LESSON 1 - TALL AND SHORT

A. Objectives

1. Identifies all tall things from a set of objects.
2. Identifies all short things from a set of objects.
3. Labels "tall."
4. Labels "short."

B. Performance of classes from "neighborhood" schools

	<u>School 1</u>			<u>School 2</u>		
	Pre	Post Lesson	Post Unit	Pre	Post Lesson	Post Unit
1. Identifies tall	73	-	100	90	-	100
2. Identifies short	81	-	91	70	-	90
3. Labels tall	45	91	64	20	80	90
4. Labels short	18	73	73	10	70	80

C. Interpretations

1. & 2. Pretest data indicate that the children were able to recognize tall and short things before the unit. It should be noted that testing was done near the end of the school year, and these classes are older than most pre-primary classes.
3. & 4. Gains are very nice on these objectives. However, the fact that School 1 declined on the Post-Unit test might indicate that the gains are somewhat temporary. It would also be interesting to obtain teachers opinions about the accuracy of pretest scores.

D. Performance of classes from "special" school

	<u>School 3</u>			<u>School 4</u>		
	Pre	Post Lesson	Post Unit	Pre	Post Lesson	Post Unit
1. Identifies tall	75	87	79	40	-	80
2. Identifies short	56	73	57	0	-	60
3. Labels tall	56	80	79	20	75	60
4. Labels short	56	100	86	0	75	40

E. Interpretations

1. & 2. The instruction seemed to be much more appropriate for School 4 (younger) than it was for the other classes tested. When asked to identify the tall person in a picture, 100% of the School 3 children were successful at pretest time.
3. & 4. Half of the School 3 children were able to utilize these comparatives on the pretest. However, the gain after instruction is still quite impressive. Indications from the few children tested at School 4 are that they didn't readily use the labels before the unit, they learned to use them in the lesson, and they started to regress after the lesson. Generally, instruction on these basic comparative terms seems most appropriate for young children.

Lesson 1 - Tall and Short

A. Purpose, Objectives, Lesson Outline, and Materials Needed

1. One teacher questioned whether the children were supposed to define "tall" and "short" as well as label and identify tall and short things.
2. It was felt the purpose and objectives were appropriate for "some" to "all" of the children in the class.
3. It was felt that "some" to "most" of the children had reached the objective before the lesson began. (One teacher noted that all but one child could label and identify, but none could define the terms.)
4. Both felt that the Lesson Outline helped in planning the use of the lesson activities and tape presentation.
5. All felt materials were easy to obtain and need not be provided.

B. Pre-Activity (1 teacher)

1. It was felt that "some" of the children in class needed the pre-activity.
 - a. "All" of children needing pre-activity benefitted from it.
 - b. Those knowing concepts were attentive (short enough) and liked showing off what they knew.
2. Time: 10 minutes
3. It was felt activity and its explanation were sufficient.

C. Tape Presentation

1. Teacher who used pre-activity felt that it had adequately prepared the children for the tape.
2. Advance Organizer - both felt the picture interested the children and that the advance organizer prepared them for the lesson.
 - a. There was some question, however, as to whether the children had attended to what was said.
 - b. Also, both teachers questioned the appropriateness of the cover picture ("sitting" tall might be confusing).
3. Words - both teachers felt the words were presented in the best order, but one teacher did not feel there was always a smooth flow from one word to the next.
4. Definitions - both felt that the children had not obtained definitions for "tall" and "short" by the end of the tape. Children were able to label and identify, but only after much review could they give a definition, and it was generally rote.
5. Elaborations - generally helpful.
No one specific elaboration was noted as being better than others, but all were considered to be good.
6. Relations - both felt the children understood the relationships between words.

7. Pictures:
 - a. #1 - good
 - b. #2 - good
 - c. #3 - adequate
 - d. #4 - adequate; seemed too crowded, was hard for children to locate the rabbit.
 - e. #5 - distracting; generally this picture confused children because they didn't get the joke; one teacher felt it was a good picture for a discussion, but was distracting when presented by the tape.
8. Time: 20-25 minutes

D. Post-Activities (1 teacher)

1. In general, it was felt that the post-activities strengthened the concepts developed in the tape presentation.
2. Required Activities
 - a. #1 - good; allowed teacher to evaluate children (which ones could label; which ones could define)
 - b. #2 - very easy; good for the one child who could not label or identify tall and short before lesson.
3. Optional Activity - used P. Mooney; children liked activity very much.

E. General Comments on Lesson

1. In general, it was felt that the purpose and behavioral objectives of the lesson were met.
2. It was felt that "some" to "most" knew the concepts of "tall" and "short" at the end of the lesson.
3. Children enjoyed lesson
 - a. Story (tape?) and game "P. Mooney says" were most popular.
 - b. Worksheet (Post-Activity #2) was least popular.
4. One teacher considered the "story" (tape?) to be the most important aspect of the lesson in insuring that the children had learned the concepts.
5. Total Time on Lesson (felt to be "about right")
 - a. 2 days - 60 minutes
 - b. 1 day - 25 minutes (teacher only used tape presentation)

LESSON 2 - TALLER AND TALLEST

A. Objectives

1. Identifies objects in a picture that are taller than a specified object.
2. Constructs a stack of blocks that are taller than the examiner's (demonstrates taller than).
3. Identifies the picture of the tallest object from a set of objects.
4. Constructs the tallest possible stack of blocks (demonstrates tallest).

B. Performance of classes from "neighborhood" schools

	<u>School 1</u>			<u>School 2</u>			<u>"Normals"</u>
	Pre	Post Lesson	Post Unit	Pre	Post Lesson	Post Unit	Pre
1. Identifies taller than	64	82	73	60	50	80	100
2. Demonstrates taller than	100	-	100	100	-	100	100
3. Identifies tallest	100	-	100	90	-	90	-
4. Demonstrates tallest	100	-	100	80	-	90	100

C. Interpretations

1. This objective was met by about 62% on the pretest and 75% on the posttest, for both schools. In contrast, children of the same age from a regular classroom performed at the 100% level. It would seem that the activities should provide more experience in picking out objects that are taller than other objects.
2. All children were able to construct a "taller" stack of blocks on the pretest, thus suggesting that the "manipulation" level would be a good place to start instruction in this concept.
3. & 4. The children seemed for the most part to have little trouble with the concept of tallest. However, in the few instances where a child did not meet the objective at pretest, the lesson did seem to help attain the objective.

D. Performance of classes from "special" schools

	<u>School 3</u>			<u>School 4</u>		
	Pre	Post Lesson	Post Unit	Pre	Post Lesson	Post Unit
1. Identifies taller than	50	67	50	40	-	80
2. Demonstrates taller than	81	-	71	80	75	100
3. Identifies tallest	62	100	93	0	-	80
4. Demonstrates tallest	81	-	71	40	100	100

E. Interpretations

1. Pretest levels are slightly lower than those of "neighborhood" classes. School 4 (youngest children) gains are impressive, as the class performed comparably to the other schools after instruction. Failure to show a sustained increase in percentage at School 3 might suggest need for more experiences.
2. With pretest data near criterion, beginning instruction at the "manipulation" level seems to be reinforced (note comments from "neighborhood" schools). Failure of School 3 children to gain might be a function of physical handicaps and not a weakness in lesson.
3. Nice gains! The lesson really seems to have worked for this objective with these kids. Note the low pretest scores in identifying tallest, especially in the younger class (School 4). Based on gains, the lesson seems to have been successful with these children.
4. Low pretest scores in demonstrating tallest at School 4 indicate a real need for instruction: Pre/post test comparison again indicates the effectiveness of the lesson. (School 3 children may have been limited by physical handicaps.)

Lesson 2 - Taller and Tallest (1 teacher)

A. Purpose, Objectives, Lesson Outline, and Materials Needed

1. It was felt the purpose and objectives were clearly stated and appropriate for "all" of the children in the class.
2. It was felt that "some" of the children had reached the objectives before the lesson began.
3. All materials (Big Picture) were provided.

B. Tape Presentation

1. Teacher agreed that no pre-activity was needed. She did note, however, that she briefly reviewed the definitions of "tall" and "short" before the tape.
2. Advance Organizer - it was unclear that the children attended to what was said; they were interested in picture.
3. Words - it was felt the words were presented in the best possible order and that there was a smooth flow between them.
4. Story format - Teacher agreed that the format was helpful in presenting the words to the children; any definitions might have been confusing.
5. Definitions - it was felt the children had functional definitions of "taller" and "tallest." It was felt they had no definition for "as tall as," and teacher commented that it was not really explained on the tape.
6. Relations - it was felt that the children understood the relationship between the words presented in the lesson.
7. Pictures: (incomplete comments)
8. Time: 30 minutes

C. Post-Activities

1. It was felt the post-activities strengthened the concepts developed in the tape presentation.
2. Required Activities
 - a. #1 - good activity, children were very much involved and liked seeing who was taller than who, and who was tallest. Took about 10 minutes.
 - b. #2 - did not do this activity.
3. Optional Activity - again class used P. Mooney and liked this activity.
4. Suggestion: There should be another activity on "as tall as" because no children in the class fit this part of the Required Activity #1.

D. General Comments on Lesson

1. There was some question as to whether or not the purpose and objectives of the lesson had been met. Teacher commented that she was not sure her children could use "as tall as," and noted that it was not used much at all in the tape or activities.

2. It was felt that "most" of the children knew the concepts at the end of the lesson.
3. Children enjoyed lesson.
 - a. The most popular aspect of the lesson was the story on the tape. Children "hated" it when teacher stopped tape to elaborate.
 - b. Least popular aspect of lesson were the points during the tape when it was stopped to "discuss" the Big Picture.
4. Teacher felt the story in the tape presentation was the most important aspect of the lesson in insuring that the children learned the concepts presented.
5. The teacher noted that she gave a brief review each day before the lesson of the words learned from previous day.
6. Total Time on Lesson (felt to be "about right")
2 days - 60 minutes

LESSON 3 - SHORT

A. Objectives

1. Identifies pictures of objects shorter than a specified object.
2. Constructs a stack of blocks shorter than the examiner's (demonstrates shorter than).
3. Identifies the picture of the shortest object from a set of objects.
4. Utilizes appropriate terms (taller, shorter, as tall as, tallest, shortest) to describe objects. [NOTE: This objective was more appropriate for the Review Activities and is discussed there (p. 20).]

B. Performance of classes from "neighborhood" schools

	<u>School 1</u>			<u>School 2</u>			<u>"Normals"</u>
	Pre	Post Lesson	Post Unit	Pre	Post Lesson	Post Unit	Pre .
1. Identifies shorter than	55	82	91	50	90	80	100
2. Demonstrates shorter than	91	-	91	80	-	100	100
3. Identifies shortest	91	-	91	90	-	90	-

C. Interpretations

1. Lower pretest scores probably indicate less previous experience with this concept (identifying objects that are shorter than others). Gains are quite satisfactory, and indicate that for the most part the lesson was successful. Note that 100% of the same-age "normals" met this objective without instruction.
2. High pretest scores indicate that at the manipulation level most children understand the concept "shorter." It seems that this might be a good pre-activity.
3. Once again, the superlative (-est) seems to be identified slightly easier at pretest than the comparative (-er).

D. Performance of classes from "special" schools

	<u>School 3</u>			<u>School 4</u>		
	Pre	Post Lesson	Post Unit	Pre	Post Lesson	Post Unit
1. Identifies shorter than	38	67	43	40	50	80
2. Demonstrates shorter than	44	73	57	60	50	60
3. Identifies shortest	62	73	57	0	50	60

E. Interpretations

1. The Post-lesson test at School 4 was given after Lesson 3, and showed only a small gain; however the Post-unit test, which was given immediately after the Review Activities, reveals a substantial gain. Thus, it seems the objective was satisfactorily met, but not necessarily because of the lesson but rather because of the Review Activities. The results from School 3 show an initial gain, but drop off to the pretest percentages. Further analysis is indicated.
2. The low pretest scores strongly suggest that this objective merits instruction with these children. It seems that neither class transferred much, if any, learning to physical demonstration of "shorter than." Yet, it would seem that instruction aimed at such an objective would definitely be appropriate for these children.
3. School 3 children have obviously been previously exposed to this concept, and unfortunately the results indicate little improvement from instruction in this unit. The School 4 children seem to have been exposed only minimally to this concept, and results indicate that 3 of the 5 children did meet this objective after the Review Activities. However, it does not seem inappropriate to expect 100% of these children to obtain such a low level objective. Thus, it would seem that the instruction should be modified for slower children.

Lesson 3 - Short (1 teacher)

A. Purpose, Objectives, Lesson Outline, and Materials Needed

1. It was felt the purpose and objectives were clearly stated and appropriate for "most" of the children in the class.
2. It was felt that "some" of the children had reached the objectives before the lesson began.
3. It was generally felt that the materials were easy to obtain and need not be provided; except, perhaps, for the pictures needed for the Review Activities.

B. Tape Presentation

1. It was agreed that no pre-activity was needed.
2. Advance Organizer - it was felt that the advance organizer was good and that the children looked at the cover picture and listened to what was said.
3. Words - it was felt that there was a smooth flow between words and that the words were presented in the best possible order.
4. Story format - teacher agreed that the format was helpful in presenting the words to the children.
5. Definitions - it was felt that the children had obtained functional definitions of "shorter" and "shortest" by the end of the tape.
6. Relations - the teacher indicated that she was unsure if the children understood the relationships between the words.
7. Pictures: (incomplete comments); it was noted that picture #2 was good.
8. Time: 30 minutes

C. Post-Activities

1. It was felt that the post-activities strengthened the concepts developed in the tape presentation.
2. Required Activity - good; showed teacher who could use the words and who couldn't. Although children did get somewhat active, the activity was good for helping them understand the use of "short," "shorter," and "shortest." Took about 15 minutes.
3. Optional Activity - children enjoy anything that is a game; the teachers think they benefit from it. Took about 5 minutes.

D. General Comments on Lesson

1. Generally, it was felt the purpose and behavioral objectives of the lesson had been met; all could identify and label the "shortest," but two children had trouble using the words "shorter than."
2. It was felt that "most" of the children knew the concepts at the end of the lesson.
3. Children enjoyed lesson
 - a. Story on tape was most popular.

- b. Stopping tape was least popular - also, it gave some children a chance to divert their attention from the story, and sometimes it was difficult to get their attention back to the story.
4. Teacher felt the story in the tape presentation was the most important aspect of the lesson in insuring that the children learned the concepts presented.
5. Total Time on Lesson
2 days - 60 minutes

REVIEW ACTIVITIES: LESSON 1-3

NOTE: Objectives presented here are those which involve decisions concerning both short and tall comparatives. Also, all "as tall as" objectives are discussed here since most of the instruction on these is found in the review activities.

A. Objectives

1. Utilizes phrase "taller than" and/or "shorter than" to compare the height of one object to the height of a set of other objects.
2. Orders objects from the shortest to the tallest (orders to tallest).
3. Identifies those from a set of pictures that are "as tall as" a specified picture.
- 4a. Utilizes phrase "as tall as" to describe objects of equal height.
- 4b. Utilizes phrase "same as" to describe objects of equal height.
- 5a. Constructs a stack of blocks "as tall as" the examiner's (demonstrates "as tall as").
- 5b. Describes the stack that he constructs as "as tall as" the other stack.

B. Performance of classes from "neighborhood" schools

	<u>School 1</u>			<u>School 2</u>			<u>"Normals"</u>
	Pre	Post Lesson	Post Unit	Pre	Post Lesson	Post Unit	Pre
1. Utilizes "taller than" and/or "shorter than"	0	45	9	20	70	90	-
2. Orders to tallest	36	45	18	20	60	70	-
3. Identifies "as tall as"	9	27	27	0	10	30	83
4a. Utilizes "as tall as"	0	0	0	0	0	0	16
4b. Utilizes "same as"	0	55	55	0	0	10	67
5a. Demonstrates "as tall as"	45	55	73	40	30	50	100
5b. Describes "as tall as"	36	55	55	0	0	10	16

C. Interpretations

1. Pretest data show that children do not typically utilize "taller than" or "shorter than" when comparing heights. The gains for School 2 are more than adequate, but obviously School 1 children did not obtain this level of using the comparatives. If this objective is important, it would seem to justify one or more activities (or lessons).
2. Pretest data are again very low. Also, the same differences between the two schools were observed as to gains. Once again, if this objective is important, more instruction must be geared to it.
3. Pretests show that EMR children could not identify "as tall as," but the "normal" children performed quite well on the task. The small gains by the end of the lesson are less than adequate and indicate a definite need for revision. The test item is unusual, but it seems to validly test the recognition of this concept. Further analysis will be conducted to determine what errors the children made in recognizing this concept.
- 4a. & 4b. No children ever utilized the phrase "as tall as." At School 1 a substantial increase was found in the utilization of "same as," but it still wasn't satisfactory since it did not reach criterion. However, School 2 children utilized neither "as tall as" nor "same as." It is important to note that only one of the "normal" children utilized "as tall as," thus it does not seem to be an essential objective.
- 5a. & 5b. All of the normal children, but less than half of the EMR children, were able to demonstrate a knowledge of "as tall as" (i.e., this would seem to justify activities aimed at this objective). The pretest data on objective 5b is fascinating with the School 1 EMRs outshining the normals. In addition, the percentage describing their blocks as, "as tall as" showed an increase after the lesson. It seems that correct performance on this objective is at least partially the result of the child being aware of what he is demonstrating.

D. Performance of classes from "special" schools

	School 3			School 4		
	Pre	Post Lesson	Post Unit	Pre	Post Lesson	Post Unit
1. Utilizes "taller than" and/or "shorter than"	0	33	43	0	25	20
2. Orders to tallest	13	27	29	0	0	40
3. Identifies "as tall as"	0	-	14	0	25	0
4a. Utilizes "as tall as"	7	7	14	0	0	0
4b. Utilizes "same as"	0	0	0	20	25	20
5a. Demonstrates "as tall as"	44	60	64	40	50	80
5b. Describes "as tall as"	0	13	0	0	0	0

E. Interpretations

1. The pretest data correspond to the results from the "neighborhood" classes (children do not typically utilize "taller than" or "shorter than"). Post-lesson data indicate a need for revisions in the lesson and/or added activities.
2. Generally, the data indicate that more emphasis is needed in instruction if this objective is important. Noteworthy is that two children from School 4 ordered correctly on the "Post Unit" test, thus, providing evidence that most of the population could obtain this objective.
3. Again, if this objective (identifying "as tall as") is important, revision to the instruction is necessary.
- 4a. & 4b. Low posttest scores confirm that for understanding the concept "as tall as" additional instruction will be necessary. (An interesting response instead of "as tall as" was "even" said by one child at School 3.)
- 5a. In contrast to the previous objectives, the data for demonstrating "as tall as" are slightly more encouraging. This reinforces the previous comment that instruction may be more effectively sequenced if begun at this "manipulation" level.
- 5b. Performance on this objective, both before and after instruction, was low. Revision of objective or instruction is indicated.

Review Activities - Lesson 1 - 3

A. General Comments

1. Both found the review activities to be helpful in reviewing the target concepts.
2. Both felt activities were sufficiently explained.

B. Required Activities

1. #1 - generally the activity was considered to be good; the "graphing" activity was especially relevant to the concepts.
 - a. One teacher used drawing paper (didn't have suggested wrapping paper) and had children do measuring in pairs.
 - b. Other teacher commented that preparing the paper and measuring each child took too much time. She suggested that the part where the strips were prepared should have been made into an art project, so the vocabulary lesson could have been concentrating on discussing the "graph."
 - c. Time: 35-45 minutes
2. #2 - children enjoyed activity, but both teachers noted a problem with using the Peabody Pictures. All pictures were the same size, and children had to be reminded to think of the animals as they were in real life. This worked with these children, but concern was expressed that it might not work with lower ability children.
 - a. One teacher made this into a game activity. Class was divided into teams, asked questions about the pictures, and given points for correct answers.
 - b. Time: 20 minutes

C. Optional Activities

1. #1 - (1 teacher) - "fun"
2. #2 - (1 teacher) - slower children had difficulty finding objects that were "taller" (windows, doors, etc., seemed to be too abstract for them). Took 10 minutes.
3. #3 - (1 teacher) - good activity; first tried 5 ladders arranged in order, but this was too hard. Then, drew them on board and gave students directions like: Put X on tallest, put ✓ on the shortest, put * on next shortest, etc.

LESSON 4: LONG AND SHORT

A. Objectives

1. Identifies things that are long and things that are short.
2. Utilizes label "long" when asked to describe a girl's dress (labels long).
3. Labels a stick as "short" when shown 2 sticks and asked "This stick is long, what is this stick?"
4. Identifies all "shorter" sticks (than one specified) from a set of sticks.
5. Constructs a row of blocks shorter than the examiner's (demonstrates shorter than).
6. Identifies a picture of the shortest object from a set of pictured objects.
7. Utilizes the label shortest to describe an object.

B. Performance of classes from "neighborhood" schools

	<u>School 1</u>			<u>School 2</u>		
	Pre	Post Lesson	Post Unit	Pre	Post Lesson	Post Unit
1a. Identifies long	72	-	100	60	80	40
1b. Identifies short	45	-	73	50	80	60
2. Utilizes long	100	-	100	78	67	80
3. Labels short	45	82	100	56	70	90
4. Identifies shorter than	73	91	91	60	90	90
5. Demonstrates shorter than	100	100	100	67	67	100
6. Identifies shortest	91	-	91	70	89	80
7. Utilizes shortest	0	18	45	0	33	40

C. Interpretations

- 1a. & 1b. Pretest data indicate that enough of the students failed these items to merit instruction. Gains after lesson are satisfactory. The lower results on the post-unit test in School 2 may be a result of distractions on the children (e.g., being tested during last week of classes).

2. School 1 children were satisfactory on this objective, even on the pretest. School 2 children were slightly less than perfect, and unfortunately they all still did not obtain this objective after the lesson.
3. Only about half the children labeled "short" correctly on the pretest. The gains are more than satisfactory with only one child not obtaining this objective on the final, post-unit test.
4. & 5. Based on pretest results, it appears that these children have nearly a complete receptive understanding of "shorter than." The post lesson and unit results are, of course, quite satisfactory.
6. Pretest scores are again quite high; once again, the superlative seems to be identified slightly easier at pretest than the comparative.
7. In contrast to the children's ability to identify, expressive use of the word "shortest" shows a definite weakness on this objective. The post-unit results (40% correct) show that this unit does not correct for weaknesses. If this objective is important, and certainly it may not be, then the lesson must change.

D. Performance of classes from "special" schools

	<u>School 3</u>		<u>School 4</u>	
	Pre	Post Unit	Pre	Post Unit
1a. Identifies long	75	71	60	80
1b. Identifies short	38	50	20	40
2. Utilizes long	81	-	20	-
3. Labels short	68	-	20	-
4. Identifies shorter than	50	-	-	-
5. Demonstrates shorter than	62	-	20	-
6. Identifies shortest	68	57	0	80
7. Utilizes shortest	0	-	0	-

E. Interpretations

- 1a. & 1b. Pretest percentages indicate "special" school classes are on about the same level as others in identifying long objects, but slightly below them in identifying short objects. School 3 failure to gain on identifying length could be the result of several factors (weakness in lesson for low kids, ceiling for some low kids); who made the errors should be determined. One additional student at School 4 mastered each of the objectives, even though the class did not receive the instruction. This seems to indicate positive transfer from Lessons 1-3. It seems the instruction should be modified to insure that any child can at least learn to identify short objects.
2. Pretest percentages from School 3 indicate extensive prior experience with this vocabulary. It would be interesting to determine if it is a function of specific instruction or just older CAs. Low pretest score for School 4 again emphasizes the low classes are in most need of comparatives. Unfortunately, time did not permit School 3 children to be posttested on these items even though they had received the instruction.
3. Given this basic objective (labeling "short"), the low pretest scores for School 4 again emphasize that low classes are in most need of the comparatives. Again the School 3 pretest percentage is above "neighborhood" classes.
4. & 5. In contrast to the "neighborhood" schools, pretest data from the "special" schools indicate a definite need for instruction at the receptive level of "shorter than."
6. & 7. The differences in scores on the two objectives are similar to those found in the "neighborhood" schools (basic receptive understanding is present and a definite need for instruction at the expressive level is indicated). The gain for School 4 is interesting since instruction was not given. This would seem to indicate positive transfer from Lessons 1-3.

Lesson 4 - Long and Short (1 teacher)

A. Purpose, Objectives, Lesson Outline, and Materials Needed

1. No comment was made on the clearness of the purpose and behavioral objectives.
2. It was felt the purpose and objectives were appropriate for "some" of the children in the class.
3. It was felt that "some" of the children had reached the objectives before the lesson began.
4. All materials were easy to obtain and need not be provided.

B. Pre-Activity - not used

C. Tape Presentation

1. Advance Organizer - it was felt the children listened to the advance organizer and attended to the cover picture.
2. Words - teacher was unsure that the words had been presented in the best possible order. It was felt that "longer" and "longest" should follow the basic definition and presentation of "long." It was confusing to do these comparatives after "short," "shorter," and "shortest" - too much of a wait.
3. Definitions - it was felt the children had obtained functional definitions of "short," "shorter" and "shortest" by the end of the tape. It was felt that the definition obtained for "long" was a rote one.
4. Elaborations - generally helpful; it was felt that all elaborations were good.
5. Relations - it was felt the children understood the relationships between the words.
6. Pictures:
 - a. #1 - adequate; it was felt the pencil should be replaced since most children consider pencils to be short, and they actually are when in same picture with a train.
 - b. #2 - good
 - c. #3 - good
 - d. #4 - good
 - e. #5 - adequate; picture should compare 3 things.

D. Post-Activities - not used

E. General Comments on the Lesson

1. Ordering of lessons was not agreed with. Story of Mr. Long, Mr. Longer, and Mr. Longest should come after presentation of word "long."
2. It was felt that the purpose and behavioral objectives of the lesson had been met.
3. It was felt that "most" children knew the concepts at the end of the lesson.
4. Children enjoyed lesson - no aspect was noted to be either most or least popular.

LESSON 5 - MR. LONG, MR. LONGER, MR. LONGEST

A. Objectives

1. Identifies all longer sticks (than one specified) from a set of sticks.
2. Constructs a row of blocks longer than the examiner's (demonstrates longer than).
3. Utilizes phrase "longer than" when given a stick longer than the examiner's and asked: "Tell me about your stick?"
4. Identifies picture of longest object.
5. Constructs the longest row of blocks that was possible in this situation (demonstrates longest).
6. Utilizes "longest" when shown a group of sticks and asked to describe the longest stick (what makes this different from all the others).

B. Performance of classes from "neighborhood" schools

	<u>School 1</u>			<u>School 2</u>			<u>"Normals"</u>
	Pre	Post Lesson	Post Unit	Pre	Post Lesson	Post Unit	Pre
1. Identifies longer	64	91	100	70	78	100	100
2. Demonstrates longer than	100	-	100	90	-	90	100
3. Utilizes longer than	55	55	91	0	33	50	32
4. Identifies longest	100	-	100	80	90	90	-
5. Identifies longest	91	-	100	78	78	90	100
6. Utilizes longest	9	18	55	0	44	50	-

C. Interpretations

1. Although about 67% of the EMR students had mastered this objective (identifies longer) before the unit, this percentage is significantly below the 100% by normal children of the same age. The test after the complete unit demonstrates the effectiveness of the instruction.

2. That the children could do this (demonstrate longer than) before the lesson implies that they understood the vocabulary word and that this might be a good activity to introduce lesson.
3. The pretest shows half the School 1 children had obtained this objective, which is a higher percentage than the "normals" showed in utilizing "longer than." The gain from 0 to 50% mastery at School 2 is noteworthy, but less than adequate. The final 91% figure from School 1 is a positive finding and confirms that more instruction is necessary in the lesson.
4. Basically, it seems that these children had obtained the objective before the unit. (The superlative again appears simpler than the comparative.)
5. Again, for the most part these classes had mastered the objective before the unit. It seems that initially longest may be an easier concept than longer.
6. This test item may not be a fair test of this utilization in that the pretest scores seem too low. If item is valid, then the final test percentages are too low, and it seems that more utilization activities would have to be added.

D. Performance of classes from "special" schools

	<u>School 3</u>		<u>School 4</u>	
	Pre	Post Unit	Pre	Post Unit
1. Identifies longer	81	-	20	-
2. Demonstrates longer than	88	-	80	-
3. Utilizes longer than	38	-	0	-
4. Identifies longest	62	71	0	60
5. Demonstrates longest	75	-	60	-
6. Utilizes longest	0	-	0	-

E. Interpretations

The School 3 pretest data fairly closely parallels that of School 1; except for objectives requiring demonstration, the School 4 percentages are substantially below that of the other schools. Based on the higher scores on both demonstration objectives (2 & 5), children with low mental ages (4 years) such as those at School 4 may need the concreteness of demonstration type activities before the instruction even attempts identification of pictured objects.

Lesson 5 - Mr. Long, Mr. Longer, Mr. Longest (1 teacher)

A. Purpose, Objectives, Lesson Outline, and Materials Needed

1. It was felt the purpose and behavioral objectives were clearly stated and appropriate for "some" of the children in the class.
2. It was felt that "some" of the children had reached the objectives before the lesson began.
3. Materials were easy to obtain and need not be provided.

B. Tape Presentation

1. It was agreed that no pre-activity was needed.
2. Advance Organizer - it was felt that the children had listened to the advance organizer and attended to the cover picture.
3. Words - it was felt that there was a smooth flow between words "sometimes" and that the words were presented in the best possible order.
4. Story format - it was agreed that the format was helpful in presenting the words to the children, and it was noted that the children really enjoyed the format.
5. Definitions - it was felt that the children had obtained functional definitions of "long" and "longest," but that the definition obtained for "longer" was a rote one. The children seemed to understand "longer" in comparison to "long," but were confused when the three words were discussed.
6. Relations - it was felt that the children understood the relationships between the words presented.
7. Pictures:
 - a. #1 - adequate; the snake pictured was too long - in this picture he (Mr. Long) was the same length as Mr. Longer was in picture #2.
 - b. #2 - good
 - c. #3 - good
 - d. Big Picture #3 - good
8. Time: 20 minutes

C. Post-Activity - not used

D. General Comments on Lesson - no comments made

Review Activities - Lesson 4 & 5 (1 teacher)

A. General Comments - no comments made

B. Required Activities

1. #1 - activity went very well; time - 23 minutes.

2. #2 - children enjoyed; would suggest that at first one child at a time would come to front to make a longer chain, then a shorter chain, etc., and then give all children chips and let them do activity on their own. Time - 15 minutes.

C. Optional Activities

#4 - good; should be required because it shows how well children understand all concepts without help from classmates. Also, it is different from other required activities - they were similar and children seemed to become restless with them.

LESSON 6: A RULER IS A FOOT LONG

A. Objectives

1. Identifies the picture of a ruler when asked to identify the thing to use to find out how long something is.
2. Labels "ruler" when shown a foot long ruler.
3. Utilizes "ruler" when asked: "What is a good thing to use to find out how tall something is?"
4. Defines what a ruler is used for by starting either "to find out how long" or "how tall something is."
5. Identifies a stick one foot long from a set of sticks of various lengths.
6. Demonstrates, with hands, how long one foot is.
7. Describes a ruler as a "foot" when asked "How long is this ruler?"

B. Performance of classes from "neighborhood" and "special" schools

	<u>School 1</u>			<u>School 2</u>			<u>School 3</u>	<u>School 4</u>
	Pre	Post Lesson	Post Unit	Pre	Post Lesson	Post Unit	Pre	Pre
1. Identifies ruler	45	73	64	20	80	90	7	0
2. Labels ruler	73	100	91	70	100	100	88	0
3. Utilizes ruler	36	91	91	0	80	89	38	20
4. Defines ruler	9	64	45	10	50	56	0	40
5. Identifies foot	18	73	70	10	40	29	31	0
6. Demonstrates foot	18	64	73	10	70	78	0	0
7. Relates ruler & foot	9	91	82	0	70	67	13	0

C. Interpretations

1. On the pretest, only at School 1 did a substantial number of students identify the ruler correctly. The gains at School 2 are impressive, but it is difficult to understand why the percentage at School 1 did not improve more. This item was given to the two low classes even though they didn't receive instruction: (1) School 3 jumped from 7% to 53%, (2) School 4 jumped from 0% to 60%. Either these students transferred something about measuring from the first five lessons (see the wording of question in part A), or they have learned how to take our tests better.

2. In all classes except School 4 a substantial majority of the children were able to label a ruler. The limited experience of the young children at School 4 certainly shows up on this objective. The lesson was effective for those who needed instruction.
3. This objective is very similar to #1 except that here the children must say "a ruler" instead of just marking it. The low pretest scores attest to its effectiveness. and the high posttest scores attest to its effectiveness.
4. The low pretest scores were expected on defining the ruler. The gains are not overwhelming, but are reasonable considering the objective required a definition from the children.
5. The data from School 1 are quite good. However, the failure of the School 2 children to show a substantial increase requires further investigation (e.g., Check with the teacher to see if she had to rush through the lesson or knows another reason for the low post scores). That nearly 1/3 of School 3 mastered this objective is noteworthy.
6. As expected, the pretest scores were low for all classes in demonstrating the length of a "foot." The gains in the two classes are certainly respectable, and probably would not be questioned. (However, the teacher at School 1 indicated that all of her children had mastered this objective.)
7. As expected, the pretest scores were quite low, with only a few children stating that "a ruler is a foot long." The gains are good, but the ideal (100%) seems like an appropriate level of achievement.

Lesson 6 - A Ruler Is a Foot Long

A. Purpose, Objectives, Lesson Outline, and Materials Needed

1. Both felt the purpose and behavioral objectives were clearly stated and appropriate for "most" to "all" of the children in the class.
2. It was felt that "none" to "some" of the children had reached the objectives before the lesson began.
3. Both felt the materials were easy to obtain and need not be provided.

B. Pre-Activity

1. It was felt that "most" to "all" of the children in the class needed the pre-activity.
 - a. "Some" to "all" of the children needing the pre-activity benefitted from it.
 - b. Those knowing the concepts enjoyed the pre-activity.
2. Time: 15 minutes
3. It was felt the activity and its explanation were sufficient.

C. Tape Presentation

1. Both felt the pre-activity adequately prepared the children for the tape presentation.
2. Advance Organizer - both felt the picture interested the children and that the advance organizer had prepared them for the lesson. One teacher questioned whether the children had attended to what was said while looking at the cover picture, however.
3. Words - both felt there was a smooth flow between words and that the words were presented in the best possible order.
4. Definitions - both felt the children had obtained a functional or generalizable definition of "ruler." One teacher felt the definition obtained for "foot" was functional while the other felt it was rote.
5. Elaborations - generally helpful
The explanation of "foot" was well done - the picture showing the different feet was "cute" and effective in getting the point across.
6. Relations - both felt the children understood the relationships between the words presented.
7. Pictures:
 - a. #1 - good
 - b. #2 - distracting; the football in picture was not exactly one foot long.
 - c. #3 - good
 - d. #4 - good
 - e. #5 - good
 - f. #6 - good
8. Time: 20-30 minutes

D. Post-Activities

1. It was felt that the post-activities strengthened the concepts developed in the tape presentation.
2. Required Activities
 - a. #1 - good review, time - 5 minutes
 - b. #2 - 10 minutes
 1. One teacher noted that the children had no problem with the concepts "longer," "shorter" or "as long as" the ruler. Children really enjoyed measuring objects.
 2. Other teacher noted that some children had difficulties with the concepts "little less" and "little more" and required more repetition and practice. Those children already understanding concepts "less" and "more" had no problems.
 - c. #3 (1 teacher) - another practice activity; it was noted that about half of the class could use "more" or "less."
 - d. #4 - children enjoyed; skill is one which mainly required practice; one teacher noted that most of her class could now approximate a foot. Time - 10 minutes.
 - e. #5 - good activity; children enjoyed; one teacher noted that the activity was very difficult for some, but with practice most could draw a straight line.
 - f. #6 - good; one teacher discussed how two people could measure same thing with different rulers (foot ruler and yardstick) by giving the measurement in terms of feet.

D. General Comments on Lesson

1. It was felt the purpose and behavioral objectives of the lesson had been met.
2. It was felt that "most" children knew the concepts by the end of the lesson.
3. Children enjoyed lesson
 - Both teachers noted that the measuring activities were the most popular.
4. Both teachers considered the post-activities to be the most important aspect of the lesson.
5. Total Time on Lesson (felt to be "about right")
 - a. 4 days - 120 minutes
 - b. 5 days - 180 minutes

LESSON 7: LET'S USE OUR RULERS!

A. Objectives:

1. Utilizes "feet" when asked: "How tall are you?"
2. Describes what the examiner is doing to measure length of a table:
 - a. utilizes phrase "how long"
 - b. utilizes term "measuring"
3. Demonstrates appropriate techniques for using a ruler to measure how long something is (demonstrates how long).
4. Relates ruler to how tall something is when asked "You can use a ruler to find out how long something is; what else can you use a ruler for?"
5. Demonstrates appropriate techniques for using a ruler to measure how tall something is.

B. Performance of classes from "neighborhood" and "special" schools

	<u>School 1</u>		<u>School 2</u>		<u>School 3</u>	<u>School 4</u>
	Pre	Post Unit	Pre	Post Unit	Pre	Pre
1. Utilizes feet	0	55	10	33	13	0
2a. Utilizes how long	0	0	0	20	7	0
2b. Utilizes measuring	82	100	20	50	56	40
3. Demonstrates how long	27	82	0	70	50	0
4. Relates ruler to how tall	9	45	0	29	0	20
5. Demonstrates how tall	18	100	7	50	18	0

C. Interpretations

1. The low pretest use of the word "feet" to describe height was expected with these children, yet it seems necessary that they understand and use this word. The data from both "neighborhood" classes indicate a substantial increase in the use of "feet", but limited time on the lesson probably restricted the posttest percentages.

- 2a. It is obvious that getting the children to say that someone is "trying to find out how long something is" is difficult to do in a test (it would be interesting to find out from the teachers if they feel that the children can describe things in this way).
- 2b. Look at all those children who use the terms "measuring" on the pretest! (two other items indicated a frequent use of variations of the verb "to measure"). Also, note the increases in the use of the word "measure" after the lesson (see if the teachers tend to use this word on their own).
3. Not many children demonstrated the right orientation for measuring either length or height on the pretest. The gains in demonstrating this orientation and related techniques are impressive, but a much more specific analysis of what they could do (e.g., measure from end to end, move ruler correctly, etc.) as well as their errors is needed.
4. This item seems to be a valid one. Even though given the hint that you can measure "how long something is," only two children said that you can also measure "how tall something is" on the pretest. The posttest results are in the right direction, but it would be very interesting to see if teachers thought that more of the children could be taught to make such a verbal response.
5. Low pretest scores indicate a definite need for instruction on this objective. The gains in demonstration of "how tall" are impressive.

LESSON 8: NEAR AND FAR

A. Objectives

1. Identifies object "closest to" a given object.
2. Utilizes "near" or "close" when asked to describe where a dog is standing in relation to a doghouse.
3. Demonstrates "closer to" when asked to move one object closer to another one.
4. Identifies object "farthest away" from a given object.
5. Utilizes "far" when asked to describe where a dog is standing in relation to a doghouse.
6. Demonstrates "farther away" when asked to move one object farther away from another one.

B. Performance of classes from "neighborhood" and "special" schools

	<u>School 1</u>		<u>School 2</u>		<u>School 3</u>		<u>School 4</u>	
	Pre	Post Unit	Pre	Post Unit	Pre	Post Unit	Pre	Post Unit
1. Identifies closest	82	100	90	100	62	93	0	60
2. Utilizes near or close	9	82	0	10	18	-	0	-
3. Demonstrates closer	100	100	78	100	93	-	100	-
4. Identifies farthest	64	91	67	80	56	79	0	60
5. Utilizes far	64	91	67	80	44	-	80	-
6. Demonstrates farther	100	100	80	90	100	-	0	-

C. Interpretation

1. It seems that this is an easy concept because: (1) High pre-test scores, (2) 100% after instruction, and (3) even schools that didn't receive relevant instruction showed substantial gains.

2. Low pretest scores on labeling "near" or "close" show a need for instruction at this expressive level. The data at School 1 are ideal, but the reason for the small gain at School 2 is difficult to determine. Possible time restrictions should be investigated.
3. Again, high pretest scores show that instruction on this concept (demonstrating closer) can be started at an earlier time (young students at School 4 also showed an understanding of this concept).
4. At all schools except School 4, the percentage starts out moderate and ends up high. The gain in School 4 from 0% to 60% again needs an explanation, since they did not receive this instruction. (Transfer from instruction on comparatives and superlatives from beginning lessons could be partial explanation.)
5. Again the percentages show improvements from moderate pretest levels to high posttest ones in the use of the word "far." Note that at School 4, 80% utilized the word on the pretest.
6. At all classes except School 4 this appears to be an easy test item. Reviewing the pretest scores on all the objectives, recommended placement of this lesson should be earlier in the unit.

Comments on Unit as a Whole

A. Ordering of Lessons in Pre-Primary Length Unit

1. All felt the comparatives should come first in the unit.
 - a. It was noted that the -er ending was harder than the -est ending.
 - b. Even though the added endings were harder, teachers generally did not agree with the suggestion that the "extremes" (tall, short, long, etc.) should be in one book and the -er and -est added later in a second book. It was felt that the -er and -est words should be taught with the "extremes."
 - c. Teachers seemed to agree with the idea of putting the distance comparatives (near-far) first, but could not decide on whether or not the -er and -est words should be taught in separate lessons or as activities within one lesson.
 - d. In lessons 4 and 5, teachers felt that the long comparatives (longer, longest) should be taught before the short comparatives (shorter, shortest). The short comparatives could easily be presented in the post-activities after the long comparatives.
2. Teachers felt the word "measure" should come before the ruler, etc., and that the lessons should get into the orientations of "how tall" and "how long."
3. "Feet" lesson should be where it is, but more is needed to just stress use of words (1 foot, 2 feet, 3 feet, etc.) and to help children measure more than one foot (where does counting begin - at end of ruler?).
4. The terms "length" and "height" should be left in their proposed position - after feet and before inch. If the children are advanced enough to go to inches, they can learn these labels.

B. Design of Materials

1. Big Picture Book - teachers noted that the only problem with the Big Picture Book presentation is that the children are exposed to so many "Big Books."
2. Review Activities - teachers liked having these set apart from the other lessons.
3. Teachers liked the idea of having a pre-organizer, with points for the teacher, and a character to introduce the tapes.
4. Use of tape presentation
 - a. In Tall and Short, for example, the Stop tapes after the definitions led the teacher to think children should end up with a definition. Perhaps the general objective or reason for stopping the tape should be noted.

- b. The Stop tapes created some problems
 - (1) They are hard for teacher to do.
 - (2) Children didn't like the interruption.Instead of stopping the tape, the teachers indicated that they would prefer a summary at the end, with a review of the definitions if appropriate.
- c. Teachers who read the script noted that it went well when they did so.
- d. Pauses - children generally don't hear the question, and even if do, don't tend to respond. Teachers noted that they generally had to stop the tape at these places.

C. Objectives of Instruction

- 1. Ordering - should include as an objective; most children should be able to order 3 objects according to length, height, etc. For more than 3 objects, many children will have trouble.
- 2. Other objectives such as "demonstration," "construction," could be included since these types of things are in the activities.

Comments on Lessons

A. Lesson 1 - Tall and Short

1. Teachers liked presenting the tall-short comparatives first - easy to relate to children.
2. Pre-Activity
 - a. No one mentioned any particular problems with the pre-activity; generally, they realized that it was not necessary for the children to get the concepts here.
 - b. After it was suggested, teachers agreed that it might help to have the activity be concrete (point out objects the child can see). This should just be an introduction by the teacher - shouldn't ask the children for responses.
3. Tape Presentation
 - a. Advance Organizer - the use of "sitting tall" seems like a different concept. It would be better if the picture showed two of the same thing - one tall and one short.
 - b. Generally, teachers felt that the tape presentation shouldn't ask the children for definitions if we don't believe it is important for the children to be able to say them.
 - c. Picture #1 caused some problems.
 - (1) Some children in youngest class didn't know what a telephone pole was.
 - (2) Showing the clouds as a reference point also created problems for some - children felt that things had to touch the clouds in order to be tall.
 - (3) All teachers indicated that the picture should show both tall and short things to give the children a base of comparison.
 - d. Picture #2 was good - no problems. This picture might make a better definition picture.
 - e. Picture #3 again needs something tall to provide a reference for comparison. (Boy in picture looks too old!) Again, there was too much stress on the definition.
 - f. Picture #4 was too crowded.
 - (1) Picture might be less distracting if the animals were in a line.
 - (2) One teacher noted that her children felt that the giraffe was tall, so the bear and the elephant couldn't be tall too.
 - g. Picture #5 wasn't meaningful to the children - they knew the boys had the wrong pants on, but didn't realize they had each other's on. There was a great deal of laughing, etc., which interfered with tape. Might be all right if discussion of picture was entirely teacher directed.
4. Post-Activities
 - a. The activity with the worksheet should come before Required Activity #1.

- b. In using the worksheet, the children couldn't seem to work with both concepts at once - maybe should suggest dealing with one concept at a time (e.g., find all tall things, find all short things).

B. Lesson 2 - Taller and Tallest

1. Tape Presentation

- a. Teachers suggested that the whole story be done, without breaks for the Big Picture.
 - Children had some trouble distinguishing the ladders - it would help if they could be different colors (or maybe even if teachers drew them for children).
- b. Summary
 - (1) Children weren't good at retelling the story; the teacher had to essentially retell the story.
 - (2) It was even very difficult to get the children to say the vocabulary words here - teacher really had to work to get kids to say the words.

2. Post-Activities

- a. There should be specific activities on the concepts "as tall as" and "same."
 - (1) Children should be able to utilize the word "same."
 - (2) Children should be able to find something "as tall as," but need not be able to utilize this phrase.
- b. Post-Activity #1 generally worked well.
 - (1) There were some problems in having all kids order at once. One teacher used three children at a time, then eventually had all children order themselves.
 - (2) Children had some problem seeing themselves to make comparisons. One teacher made marks on the board so they could see their heights, and then order themselves.
- c. Post-Activity #2 worked for a while in the lowest class, but there were too many distractions.

C. Lesson 3 - Short

1. Tape Presentation

- a. Again the use of the Big Picture during the story was a problem in two of the three classes (not in the lowest class).
 - b. Picture #2 was difficult for many children - perspective problem.
 - c. Picture #5 also created perspective problems.
2. Required Post-Activity - teachers noted that they couldn't start out with one short individual and then go to shorter, etc. They had to start with the tallest, then go to the shorter, etc.

3. Review Activities, Lessons 1-3

- a. Required #1 - activity should definitely be cut into two parts (first part as art project; comparison of strips as vocabulary activity).
- b. Required #2 - several picture problems related to drawings in Peabody Kits. Vocabulary project will have to draw these pictures.
- c. An activity on ordering could probably be added here.
- d. Optional #1 - children didn't make up own riddles.
 - When #2 was combined with #1 in a game-type activity, the activity worked better.

D. Lesson 4 - Long and Short

- 1. Pre-Activity - no specific comments were noted here. But, teachers did note that in the lesson there was some confusion about orientation. The children still tended to be concerned with "up and down." Perhaps concrete examples would also be more helpful here.
- 2. Tape Presentation
 - a. Cover picture really shows "big" and "small," not "long" and "short." The objects pictured need to be the same thing, with different lengths.
 - b. Children didn't seem to enjoy this lesson as much as others.
 - (1) The lesson was very long.
 - (2) Children didn't pay much attention because it wasn't a story.
 - (3) Pictures not as interesting as others.
 - c. Picture #1 - needs something to compare "long" to; perhaps two ropes, one long and one short.
 - d. Picture #2 was good.
 - e. The use of up and down example for length (e.g., long dress, long hair) was confusing. Should stay with the side to side orientation at least until children have concepts.
- 3. Post-Activities
 - a. The worksheet (#2) should be the first activity.
 - b. Children had no trouble doing Required #1 - did fairly well drawing objects.
 - c. Length Worksheet #2 had some problems:
 - (1) Ropes were very difficult
 - (2) Tables had a bad perspective.
 - d. Optional Activity was not used, but several teachers indicated that it might cause problems.

E. Lesson 5 - Mr. Long, Mr. Longer, Mr. Longest

1. Tape Presentation

- a. Major problem arose from using the words as names for the snakes. Too much to say or listen to.

- b. Picture problem from #1 to #2 - Mr. Long shrinks. Pictures of snakes really need some reference items so children can easily tell which snake is which.
 - c. Lesson was short; therefore, the stop tapes generally were no problem. Problems with stop tapes did arise when they were in the middle of the page - children were ready to turn the page when they weren't supposed to.
 - 2. Post-Activities - no problems
 - 3. Review Activities, Lessons 4 and 5
 - a. "As long as" should have the same types of objectives as noted for "as tall as."
 - Teachers raised a question about why "as short as" was not taught.
 - b. Teachers indicated that the words "longer than" should not be presented as such.
 - Stressing this as the word just adds another word which confuses the children.
 - c. Activities which require the children to find something in the room are very difficult
 - d. One teacher felt that Optional Activity #4 should be required because it is something different (not just finding or picking out objects).
- F. Lesson 6 - A Ruler Is a Foot Long
- 1. Pre-Activity
 - a. Story idea was a little confusing - rather than making up story about teacher getting book cover, just say "I want to measure this..."
 - b. Use of "3 pencils long" was very difficult.
 - 2. Tape Presentation
 - a. Picture #2 - football was incorrect - not a foot long.
 - b. Picture #3 - cute; good introduction to foot.
 - c. Picture #5 and explanation - children had no trouble understanding this.
 - 3. Post-Activities
 - a. Activities have to be more individual - children need much more practice.
 - b. Children could not get idea of "less than." Teachers did use "almost," "shorter than," and "longer than," but felt that it is confusing to introduce these when the children are still getting the basic idea of "foot." It was suggested that we just shouldn't talk about things that aren't a foot - say it's "almost" a foot.
 - 4. Comments on test were made spontaneously here, about the test item for identifying a foot (using sticks).
 - a. It was felt that the test item should not use so many sticks (testers indicated that children were presented with approximately 6 sticks).

- b. Teachers wondered what closest distractor was. Seemed to be very close to a foot in length (testers indicated it was 9"; however, children erred by selecting the longest stick - 18" - not by selecting the 9" stick).

G. Lesson 7 - Let's Use Our Ruler

- 1. Tape Presentation
 - a. In all pictures showing measuring, the measuring should be started at the end.
 - b. Picture #4 - trunk gave kids a perspective problem; wanted to measure diagonally.
- 2. Post-Activities - might want more activities on "more than," "less than" here, not before.

H. Lesson 8 - Far and Near

- 1. Suggested that this lesson could be first - maybe even as a series of lessons.
- 2. Tape Presentation
 - a. Picture #4 - elaboration - it was very hard for the teacher to evaluate the children's answers here - need a different example.
 - b. Picture #5 - bear looks harmless, but children responded very well.

Discussion

The data from the formative evaluation of the Length Unit were used to develop a revised Measurement of Length Unit. Each of the sources of feedback reported in the Results section of this paper (i.e., testing, teacher evaluation forms, Teacher Review Board Meeting, and classroom observations) provided important information about the pilot-test version of the Length Unit. For example, the test data and classroom observations indicated specific areas where instruction was weak. The evaluation forms tapped the teachers' immediate reactions to each aspect of the lessons in the Unit, and the Teacher Review Board Meeting allowed the teachers to discuss their reactions with the project directors and with other teachers, and to make final recommendations for revision.

Six aspects of the pilot-test version of the Length Unit were evaluated, as specified in the formative evaluation design (cf. Krus, Thurlow, Turnure, Taylor, & Howe, 1974): 1) Need for instruction, 2) Instructional effectiveness, 3) Design of the materials, 4) Content, 5) Sequencing, and 6) Test instruments. Each feedback source provided specific information about one or more of these aspects, and generally, every aspect was evaluated on the basis of feedback from several sources. In all cases, the information from all sources was reviewed by project directors and by the individuals responsible for revising the Unit. This composite evaluation of the pilot-test version was then used to revise the Unit.

The need for a program of instruction to teach length measurement concepts and skills to EMR children was supported by the pretest data obtained during the formative evaluation. For example, the utilization of even simple comparatives (e.g., "taller") was as low as 10%, while the utilization of the more complex "as tall as" showed 0% mastery at pretest, and even the identification of an instance of this term was quite low (i.e., 5%). More skill-related objectives similarly showed a need for instruction (e.g., Identifies foot: 14%).

The instructional effectiveness of the Length Unit was given major attention during the formative evaluation stage, and served as the primary rationale for revising instruction. All stated objectives of the instruction were tested in both pretests and posttests. In addition, testing occurred frequently during the instruction (in post lesson tests), with objectives not reaching the 80% criterion level being retested to determine if related instruction affected mastery. Data from all of these tests pointed to specific areas where instruction had not been effective. For example, in this pilot-test, the data indicated that the equivalence concepts (e.g., "as tall as." "as long as," "as far away as") were very difficult for the children, even after instruction had been completed. The posttest mastery level of 5% on the "as tall as" identification objective, for instance, clearly indicated that additional instruction related to this concept was needed. In addition, the discrepancy between receptive understanding of these terms and expressive use of the terms, in combination with the low level of performance of normals in expressive usage, led to the questioning of the appropriateness of the objectives, and the subsequent de-emphasis of these concepts in the revised unit.

The evaluation of the instructional effectiveness of the Length Unit also identified strong and weak performances which related to sequencing problems. For example, for each set of comparatives tested, the children consistently performed better on items which required manipulation rather than identification or utilization. Such findings suggested that the sequence of instruction should be changed so that manipulation would be introduced first, then identification, and finally, utilization.

Specific problems in the instruction, such as those noted above, were subjected to careful scrutiny to determine whether the problems arose from testing procedures, instructional content, the sequence of instruction, or from the design of the materials themselves. All sources of feedback were consulted to make final decisions as to revisions.

A general evaluation of the needs of slower children (i.e., TMR children) and the potential effectiveness of the Length Unit for them was also incorporated into the present formative evaluation. Although the needs of this population were clearly evident, the evaluation of instructional effectiveness indicated that revisions in the instruction needed to be made in the areas of sequencing, content, and the design of the materials. These needs were kept in mind during the revision of the Length Unit, especially in the revision of the instruction on the comparatives, the area felt to be most relevant to the very young and the more severely handicapped EMR child.

Several extensive changes were made in the design of the materials as a result of the formative evaluation of the Length Unit. The largest change involved the change from separate levels of instruction (Pre-primary and Primary) to sequential instruction. The decision to make this revision was made when the data from this pilot-test confirmed the findings that 1) the lower level of instruction was often needed by "primary" children, and 2) pre-primary children could often proceed to the "primary" level of instruction. These observations were originally made in the pilot-test of the Money Unit (cf. Thurlow, Krus, Howe, Taylor, & Turnure, 1974) and were then formatively evaluated in the Time with the Clock Unit (cf. Krus, Howe, Thurlow, Taylor, & Turnure, 1975).

Several other revision needs were identified during the formative evaluation of the Length Unit. These needs had also been identified during the formative evaluation of the Money Unit (cf. Thurlow, Krus, Howe, Taylor, & Turnure, 1974), which took place at approximately the same time as the Length formative evaluation. For example, the tape presentations were improved so they would be more interesting and effective for the children. A major area of concern in the tape presentations was the advance organizer, whose purpose was to obtain the children's attention and to introduce them to the content of the presentation. Data from teacher evaluation forms indicated that these purposes were not being met. In the Teacher Review Board meeting, the use of an introductory tape lesson (to accustom the children to listening to a tape presentation and simultaneously

looking at pictures, before actual instruction started) and a central character (to introduce the introductory lesson and all other lessons) were proposed. In the revised Measurement of Length Unit, a small boy named Benji became the central character. Before implementing this revision into the field-test version, however, its potential effectiveness was assessed using a "Mr. Time" in the pilot-test version of the Time with the Clock Unit (Krus, Howe, Thurlow, Taylor, & Turnure, 1975).

One revision, suggested by the formative evaluation of the pre-primary level of the Money Unit was that the use of "stop tapes," which allowed teachers to review definitions, etc., was very effective. In light of this feedback, the technique was frequently employed in the pilot-test version of the Length Unit. It was found, however, that this frequent use, at least in certain types of tape presentations, created several problems. Specifically, when a story format was employed, the introduction to teacher-classroom discussion frustrated the children and distracted them from the instruction. This was especially true when the "stop tape" technique was employed while the children were looking at one picture. These findings were extremely important, for they indicated that an overall rule for when to include teacher discussion (e.g., before turning to a new picture) could not be made. Rather, the flow and content of each tape presentation had to be considered. Thus, in the Length Unit, the tape presentations which presented the base words for the comparatives (e.g., tall, short) allowed for frequent classroom discussion, while those which presented the -er

and -est forms (e.g., taller and tallest) did not, but instead incorporated an extended review following the complete tape presentation.

Another change which was also indicated in the formative evaluation of the Money Unit was from the use of individual student texts to the inclusion of Big Picture Books for lower levels of instruction (cf. Thurlow, Krus, Howe, Taylor, & Turnure, 1974). The revised version of the Measurement of Length Unit utilized a Big Picture Book for the first book of instruction; the remaining two books retained the individual student texts. Again, specific picture changes were made where problems were noted by the teachers and by the individuals making classroom observations.

Changes in the actual design of the teacher's editions included:

- 1) The incorporation of boxed NOTES to the teachers to draw their attention to specific instructions which were very important to the success of the unit,
- 2) increased use of teacher-directed activities
- and 3) the specification of purposes for all activities included in a lesson of instruction.

Several revisions were made in the content of the Length Unit as a result of the formative evaluation. For example, greatly expanded instruction on the equivalence terms (e.g., "as tall as") was included in specific review lessons (see Appendix 5), and the objectives requiring expressive use of these terms were made optional. In fact, the major content alteration of the pilot-test version of the Length Unit (both pre-primary and primary) involved

the inclusion of greater instruction on all concepts presented, and the inclusion of more advanced concepts such as "feet and inches." Instruction on other terms, such as "mile" was dropped. In other cases (e.g., "block") it was made optional. These decisions were made in response to teachers' arguments that these were not central to the measurement skills their children would need. Generally, all feedback sources indicated the need for more emphasis on actual measuring skills (e.g., where to put the ruler, how to move it, etc.). This was accomplished by including a greater number of skill-related activities in the revised Measurement of Length Unit.

Of course, numerous small content changes were made during the revision of the Length Unit -- too many to discuss in detail here. Many of the changes made can be identified by comparing the pilot-test version with the revised field-test version. Investigation of Appendix 5, which describes the revised version of the Length Unit, (in comparison with Appendix 1) will also reveal many of the content changes which resulted from the formative evaluation of the Length Unit.

The sequencing of instruction in the Length Unit underwent dramatic changes as a result of the formative evaluation. Generally, of course, these changes were made when content problems arose.

Major changes were made in the sequencing of instruction with respect to the comparatives. First, the near -- far comparatives were moved to the beginning of the instruction. This revision was made on the advice of individuals collecting effectiveness data (see p. 39), and the consensus reached at the Teacher Review Board meeting that these terms were easier for their children than the tall -- short

and long -- short comparatives.

In addition, the sequencing of instruction within comparatives was changed. The test data consistently indicated that the order of presentation should be "manipulation" to "identification" to "utilization." Thus, for each set of comparatives, pre-activities involving concrete examples of the terms (and whenever possible, involving manipulation) were included. The objectives of demonstration and identification were the major objectives for each lesson until a review lesson on each set of comparatives, where the goal of utilization was introduced.

Test data had also indicated that the superlatives (-est terms) were easier to learn than the comparatives (-er terms). Suggestions that a sequence change be made reflecting this finding was rejected by members of the Teacher Review Board, however, who insisted that presentation of just the superlatives would be meaningless unless the children were also introduced to the comparatives.. This opinion was felt to be valid, and the materials were not revised with superlatives preceding comparatives.

Of course, the overall format change (from a two-level unit to a unit consisting of three books) had a great effect on the sequence of the lessons in the entire Unit. Appendix 5 (again, in comparison with Appendix 1) provides an excellent picture of the lesson sequence changes made in the Length Unit. The first book of the revised version contains only the instruction on the comparatives, with revisions and extensions in content. Instruction which once included six lessons was revised to include twelve lessons. Book Two of the revised unit

covered the content of Lessons 6 and 7 of the Pre-primary unit and Lessons 1, 2, and 3 of the Primary unit. Book Three corresponded to the remaining five Primary lessons (excluding Lesson 9), with instruction greatly expanded.

A final outcome of the formative evaluation of the Length Unit related to testing procedures. Teacher feedback on test items and the test data, along with revisions in sequence and content, allowed for the revision of the 60-item pilot-test instruments to a 24-item test for field-test purposes (see Appendix 6).

Revisions in the design, content, and sequencing of the Length Unit, and the accompanying tests, grew directly out of the formative evaluation of the Length Unit. The value of including this step in the overall evaluation plan of the Vocabulary Development Project (cf. Krus, Thurlow, Turnure, Taylor, & Howe, 1974) was confirmed by the relatively final form of the Length Unit which resulted (Krus, Thurlow, Turnure, & Taylor, 1974). The formative evaluation process employed here is one which has been used by the Vocabulary Development Project to evaluate other instructional units, and one which would be valuable to many other development and evaluation projects.

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Footnotes

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APPENDICES

1. A Description of the Pilot-Test Version of the Length Unit
2. Length Unit Pilot-Test Questions
3. Sample Evaluation Form
4. Classroom Observation Forms
5. A Description of the Revised Version of the Measurement of Length Unit
6. Revised Length Unit Test

A DESCRIPTION OF THE PILOT-TEST VERSION OF THE LENGTH UNIT

Pre-Primary Length Unit

The Pre-Primary Length Unit presents the comparatives of height, length, and distance, and introduces one of the tools and one of the standard units for measuring length. There are eight lessons in this unit.

The first five lessons in the Pre-Primary Length Unit present the comparatives of height and length. These comparatives provide the children with a foundation upon which other concepts more directly related to measurement skills can be built.

Lesson 1: "Tall and Short"

Vocabulary Words: TALL, SHORT

The children are taught the basic comparatives related to height (tall and short). These "absolute" comparatives serve as a foundation for teaching the meaning of the more frequently used comparatives of height (taller, tallest, shorter, shortest).

Lesson 2: "Taller and Tallest"

Vocabulary Words: TALLER, TALLEST, ("AS TALL AS")

Within a story context, the children are given a review of the definition of "tall", and are introduced to the comparatives "taller" and "tallest". Several activities are provided to show the children that the terms "taller" and "tallest" are comparatives for objects of all heights, not just tall objects. The term "as tall as" is introduced in the post-activities, where the children encounter objects of the same height.

Lesson 3: "Short"

Vocabulary Words: SHORTER, SHORTEST

Within a story context, the children are given a review of the definition of "short", and are introduced to the comparatives "shorter" and "shortest". Several activities are provided to show the children that the terms "shorter" and "shortest" are comparatives for objects of all heights, not just short objects.

Following Lesson 3, a set of Review activities is provided to insure that the children have mastered the comparatives of height presented in Lessons 1 - 3. The comparatives of length are then presented in Lessons 4 and 5.

Lesson 4: "Long and Short"

Vocabulary Words: LONG, SHORT, (SHORTER, SHORTEST)

The children are taught the basic comparatives related to length (long and short). These "absolute" comparatives serve as a foundation for teaching the meaning of the more frequently used comparatives of length (longer, longest, shorter, shortest). Because of the similarity of the length comparatives "shorter" and "shortest" to the height comparatives "shorter" and "shortest", the meanings of these concepts in relation to length are presented here.

Lesson 5: "Mr. Long, Mr. Longer, Mr. Longest"

Vocabulary Words: LONGER, LONGEST, ("AS LONG AS")

Within a story context, the children are given a review of the definition of "long", and are introduced to the comparatives "longer" and "longest". Several activities are provided to show the children that the terms "longer" and "longest" are comparatives for objects of all lengths, not just long objects. The term "as long as" is introduced in the post-activities, where the children encounter objects of the same length.

Following Lesson 5, a set of Review activities is provided to insure that the children have mastered the comparatives of length presented in Lessons 4 and 5. Lessons 6-8 present a basic tool (ruler) and standard unit (foot) of measurement, and relate these to the measurement of height, length, and finally, distance.

Lesson 6: "A Ruler is a Foot Long"

Vocabulary Words: RULER, FOOT

The children are introduced to a standard tool (ruler) and unit (foot) for measuring length. Although the children are not taught the word "standard", they are taught the underlying concept (i.e., the ruler and the "foot" are used in measuring because they are the same length for everyone). In line with this objective, the children are given experiences in judging foot distances without the use of a ruler.

Lesson 7: "Let's Use Our Ruler"

Vocabulary Words: FEET, "HOW LONG SOMETHING IS",
"HOW TALL SOMETHING IS"

Within a story context, the children are taught that "feet" is the term used when objects are more than one foot long, and that a ruler can be used to measure not only length ("how long something is") but also height ("how tall something is"). These concepts are related to each other in the post-activities, where the children are given beginning experiences in how to measure using a ruler.

Lesson 8: "Far and Near"

Vocabulary Words: FAR, NEAR, CLOSE, (CLOSER
CLOSEST, FARTHER, FARTHEST,
"HOW FAR AWAY SOMETHING IS")

The children are taught the basic comparatives related to distance (far and near or close). These "absolute" comparatives serve as a foundation for teaching the meaning of several other comparatives of distance (closer, closest, farther, farthest), which are presented in a post-activity. One of the major purposes of this lesson is to show the children that distance ("how far away something is") can also be measured using a ruler.

Following Lesson 8, a Review activity is provided which relates and summarizes all the concepts presented in the Pre-Primary Length Unit.

Primary Length Unit

The Primary Length Unit presents several standard tools and units for measuring length. There are nine lessons in this unit.

The first lesson of the Primary Length Unit serves as a general introduction to the whole unit by presenting the concept of measuring.

Lesson 1: "Let's Measure"

Vocabulary Word: MEASURE

The children are introduced to the process of measuring as a means for determining length ("how long something is"), height ("how tall something is"), and distance ("how far away something is"). The lesson is entirely teacher-directed and shows the children all the tools used in making these measurements.

Lessons 2 - 6 present the two most common standard tools and units for measuring length and height.

Lessons 2: "How Long Is It?"

Vocabulary Words: RULER, FOOT

The children are introduced to the most familiar standard tool (ruler) and unit (foot) for measuring length. The foot unit is introduced first in the sequencing of the Length Unit because of its direct relation to the ruler, and the belief that it is conceptually easier for the children to progress from the ruler to the foot, and then later to the smaller unit of measurement, the inch. This lesson and the next one are essentially the same as those presented in the Pre-Primary Length Unit, and children who received the Pre-Primary Unit are expected to skip these lessons.

Lesson 3: "Feet"

Vocabulary Word: FEET

The children are shown that many things are more than one foot in length, and are taught that "feet" is the term used when these objects are measured. As in the Pre-Primary Unit, the post-activities give the children beginning experiences in how to measure using a ruler.

Lesson 4: "Length and Height"

Vocabulary Words: LENGTH, HEIGHT

The children are taught the "grown-up" words for "how long something is" and "how tall something is". The use of the ruler in measuring these two dimensions in terms of "feet" is presented in the post-activities.

Lesson 5: "Inch"

Vocabulary Word: INCH

The children are introduced to a second standard unit of measurement (the inch) and are shown its relationship to the ruler and the foot unit. As in Lesson 2, the idea of a "standard" is stressed, and the children are given several experiences in judging an inch distance without the use of a ruler.

Lesson 6: "Inches"

Vocabulary Word: INCHES

In a teacher-directed lesson, the children are taught that "inches" is the term used to refer to more than one inch. The children are given several experiences in measuring the length and height of objects up to 12 inches long, and are taught that 12 inches is equivalent to a foot.

The last three lessons in the Primary Length Unit present several standard tools and units used to measure objects of greater length and height, or to measure distance.

Lesson 7: "Yard and Yardstick"

Vocabulary Words: YARD, YARDSTICK

The children are introduced to a third standard unit of length (the yard), and to a second measuring tool (the yardstick), and are shown that these are often used to measure things when they are longer or taller than one foot. The children are taught that three feet are equivalent to one yard, and in the post-activities are shown that a yardstick can be used to measure things in yards, feet, or inches.

Lesson 8: "Distance and Tape Measure"

Vocabulary Words: DISTANCE, TAPE MEASURE

The children are taught the term "distance" for the concept "how far away something is", and are introduced to the tape measure as another standard unit of measurement which is frequently used to measure distance.

Several experiences in the use of the ruler, yardstick and tape measure for measuring length, height, and distance are provided in the post-activities.

Lesson 9: "Block and Mile"

Vocabulary Words: BLOCK, MILE

The children are introduced to two additional measures of distance, the block and the mile, and are shown the relationship between the two.

LENGTH UNIT PILOT-TEST QUESTIONS

Pre-Primary Length Test
Group Administration

1. Look carefully at the things on this page and pretend that they are real. Find the picture of the short things. Mark an X on everything that is short.
2. Look at all the things on this page and pretend that they are real. Find the pictures of the tall things. Mark an X on everything that is tall.
3. See the tall boy in this picture. Well, some of the snowmen in the picture are even taller than the boy. Look at each snowman and mark an X on him if you think that he is taller than the boy.
4. Look at all the trees on your page - and pretend that they are real trees. I want you to mark an X on the tallest tree. Put an X on the tallest tree.
5. Let's pretend that everything on this page is real. Find the picture of the dog on this page. Now, look carefully at the other things on the page and mark the things that look shorter than the dog. Make an X on the objects that are shorter than the dog.
6. Pretend that all these trees are real. This time find the shortest tree. Make an X on the shortest tree.
7. Look at the pictures of all the ties. I want you to mark the pictures of the ties that you think are long. Mark an X on every long tie.
8. Look at the pictures of the ties on this page. This time I want you to mark all the short ties. Make an X on every short tie.
9. Look carefully at all the pictures on this page. Find the best thing to use to find out how long something is. Make an X on the picture of the thing that you could use to find out how long something is.
10. Find the picture of the boy on your page. Now find the snowman that is the closest to the boy. Make an X on the snowman that is the closest one to the boy.
11. Find the picture of the boy. This time I want you to find the snowman that is the farthest away from the boy. Make an X on the snowman that is the farthest away from the boy.
12. Look carefully at the pictures of the pencils on this page - find the shortest pencil. Put an X on the shortest pencil.
13. Now, find the longest pencil. Put an X on the longest pencil.

1. Look at all the children in this line. Find the tall boy and point to him. ☐ Y ☐ N
2. OK, this is a tall boy. What is this boy? (short) _____
(prompt) What's another word for little or small? (short) _____
3. OK, what is this girl? (tall) _____
4. Look at these pictures of the 5 hills of ice cream. See the hill in the box. Now find any other hills that are "as tall as" the hill in the box. Point to the hills which are "as tall as" the hill in the box.

If response includes: 2 hills exactly "as tall as" = ☐ Y

1 hill exactly "as tall" and 1 "taller" = ☐ N

includes: 2 hills exactly "as tall" and 1 "taller" ASK:

We only say that two of these are as tall as the hill in the box. Which 2 hills are as tall as the hill in the box.

5. Put these 4 things in a row, so that the shortest one is here (demonstrate) and as you go this way each thing is taller.

Each one gets taller as they go. ☐ Y ☐ N

(If not in correct order, order them then ask #7)

6. (Point to the tallest object). Why does this belong here? If they say it is taller or tall, ask: What makes this tall thing different from all the others?

(prompt) If they say it is shorter or short, ask: What makes this short thing different from all the others?

7. What can you tell me about how tall this thing is? (Point to the middle object). If response is shorter than or taller than, but not both, ASK: What else can you tell me about how tall this is?

(prompt) It is shorter than these, what about next to these?

8. (Shown a stack of blocks 4 high). Make a stack of blocks taller than my stack. Stack the blocks so you pile is taller than mine.

☒ Y ☐ N # _____

Break the stack.

9. Now, I want you to make the tallest pile you can from your blocks.

☒ Y ☐ N

10. (Shown a stack of blocks 4 high). Now, look at my stack of blocks. This time I want you to make a stack that is shorter than my stack. Stack the blocks so your stack is shorter than mine.

☒ Y ☐ N # _____

11. I'll make a stack with these blocks. (Stack up 5 blocks). Now, I want you to make a pile that is "as tall as" my pile.

☒ Y ☐ N # _____

12. How tall did you make your pile? _____
-

(prompt)

13. What can you tell me about how tall the pile is that you made?

same as =

as tall as = _____

Pre-Primary Length Test

Name _____

Individual Administration

School _____

Part II

Teacher _____

Date _____

14. (Examiner holds up a long stick and a short stick)

This stick is long. What is this stick? (short)

15. (Shown a picture of 4 colored pencils) (Examiner points to the shortest pencil) What can you tell me about the red pencil?
(it's the shortest)

(prompt) (If response is short or shorter, ASK:) What's the other word we use to talk about this pencil? _____

or Yes, it is short(er). Can you tell me anything else about it?

16. Now look at the blue pencil. This blue pencil is short. What can you tell me about the green pencil? (it's shorter than the blue pencil)

(prompt) Is the green pencil longer than the blue pencil? (no)
What is it? (shorter)

or How is the green pencil different from the blue pencil?

17. I'm going to put some blocks together. (Line up a row of 5 blocks, and ASK:) Now you make a row shorter than what I made. Put your blocks in a line so your line is shorter than mine.

Y # _____ N

18. Now, make something that is longer than what I made. Put your blocks in a line so your line is longer.

Y # _____ N

19. What can you tell me about this girl's dress? (it's long)

(prompts) What else? _____

Is her dress short? (no)

If it's not short, what is it? (long)

20. (Place 4 sticks on table in front of child - point to the longest stick and ASK:) What's so special about this stick? (longest)
- (prompt) What can you tell me about this stick? _____
21. (Put away 2 of the sticks). Look at these 2 sticks. (Give child the longer of the two sticks) What can you tell me about your stick? (it's longer)
- (prompts) What else? _____
- Is your stick fatter than mine? What is it? _____
- Is your stick shorter than mine? (no) What is it? _____
22. (Examiner holds up one stick). Find the other sticks on the table that are shorter than this stick. Hand me the shorter sticks.
- Y N
23. (Examiner holds up one stick). Find the other sticks on the table that are longer than this stick. Hand me the longer sticks.
- Y N
24. This stick isn't shorter than this one, what is it? (as long as)
- This stick isn't shorter than this stick, and it's not longer than this stick, either. What is it? (as long as)
- (prompt) Is this stick shorter than this one? What is it? (as long as)
25. (Examiner holds up a stick). Find the stick that is as long as my stick. Hand me the stick that is as long as my stick. (Examiner places stick on table by other sticks.) Y N
26. Put your blocks in a row so you make the longest line of blocks you can.
27. (Examiner constructs a row of 4 blocks). Now, you make a line of blocks so it's as long as mine.
28. What is a good thing to use to find out how long something is?
(ruler)
29. (Shown a ruler). "What is this called? (ruler)
- Have you ever used a ruler? Y N (pure information)

30. Why do you use a ruler? (to find out how long and how tall things are)

31. How long is this ruler? (foot)

If response is 12, ask: 12 what?

If 12" - ask: What's another way of saying twelve inches? _____

REMOVE RULER

32. Show me - with your hands - about how long one foot is (note child's response and accuracy of the response).

33. Look at everything on this table. Find the one thing that you think is about one foot long. ☒ Y ☐ N

34. You could use a ruler to find out how long something is - what else can you use a ruler to find out? (how tall something is)

35. (Examiner measures with a ruler how tall a table is and ASKS:) What am I doing?

36. (Examiner measures with a ruler how long a table is and ASKS:) What am I doing?

37. How would you find out how tall this table is? _____

38. How would you find out how long this table is? _____

39. Now here's a ruler. Find out how tall this table is. Tell me how tall this table is.

40. Use the ruler to find out how long this table is. Tell me how long this table is.
-

41. How tall are you? _____

42. (Show a picture of two dogs, one next to the dog house, and ASK:) This dog is standing far away from the dog house---where is this dog standing?

(near or close to the dog house)

(prompt) What other word could you use?

43. This dog is standing next to the dog house - he is near the dog house - where is this dog standing?

(far away from the dog house)

(Given 2 dolls).

44. Move the boy doll closer to the girl doll.

☐ Y

☐ N

45. Move the boy doll farther away from the girl doll.

☐ Y

☐ N

46. Move the boy doll a little farther away.

☐ Y

☐ N

47. Move the boy doll closer to the boy doll.

☐ Y

☐ N

SAMPLE EVALUATION FORM

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LENGTH UNIT
Pre-Primary

Teacher _____

School _____

Lesson # 1 Title Tall and Short

Date _____

Purpose, Behavioral Objectives, Lesson Outline, and Materials Needed

Purpose and Behavioral Objectives

Were the purpose and objectives stated clearly enough for you to understand the goal of the lesson?

	<u>None</u>	<u>Some</u>	<u>Most</u>	<u>All</u>
For how many children in your class were the purpose and objectives appropriate	()	()	()	()
How many children did you feel had reached the objectives <u>before</u> the lesson was presented?	()	()	()	()

Lesson Outline

Did the lesson outline help you in planning the use of the lesson activities and the tape presentation?

Materials Needed

Were you able to obtain the materials that were required?

Did you feel any of the required materials should have been provided?

Pre-Activity

This pre-activity was designed to be structured for you.

	Yes	No	Unsure
Was it helpful for the activity to be as structured as it was?	()	()	()
Was the activity structured enough?	()	()	()
Were the steps in the activity clear? Could you see the rational behind the steps?	()	()	()

Are there any ways in which you would change the structure of the activity?

	None	Some	Most	All
How many children in your class did you feel <u>needed</u> the pre-activity?	()	()	()	()
Of the children who needed the pre-activity, how many benefitted from it?	()	()	()	()

What was the effect of the pre-activity on those children who you felt did not need the pre-activity?

How long did it take your class to complete the required pre-activity?

What do you think is the minimum amount of time in which the pre-activity could be completed?

What do you think is the maximum amount of time it could take to complete the pre-activity?

Was the pre-activity sufficiently explained so that you could direct it without difficulty?

Are there any other activities which you feel should be included as pre-activities?

Lesson # _____

Tape Presentation

	Yes	No	Unsure
Did the pre-activity adequately prepare your class for the tape presentation?	()	()	()

Advance Organizer

	Yes	No	Unsure
Did the advance organizer interest the children and get them to look at the cover picture?	()	()	()
While looking at the cover picture, did the children attend to what was said?	()	()	()
Did you feel the cover picture was appropriate for the advance organizer and the tape presentation as a whole?	()	()	()
Did the advance organizer succeed in preparing the children for what the lesson was designed to teach them?	()	()	()
Did the advance organizer prepare <u>you</u> for the tape presentation?	()	()	()

Presentation of Words

	Yes	No	Unsure
Were the words presented in the best possible order?	()	()	()
Did you feel there was a smooth flow from one word to the next in the tape presentation?	()	()	()

Always Sometimes Not Usually

(Definitions): Following the tape presentation, did you feel the children had obtained definitions for each of the words presented in the tape?

() Yes () No

List each word in the lesson and the type of definition you feel most of the children in your class obtained for that word (i.e., none, rote, non-generalizable, functional, etc.).

(Elaborations): Overall, were the elaborations (stories), distracting or helpful to the children?

☐ Helpful ☐ Distracting ☐ Neither

List any elaborations which you felt were especially superior or inferior.

(Relations): Did you feel the children understood the relationship between the words by the end of the tape presentation?

☐ Yes ☐ No ☐ Unsure

List the numbers of the pictures and/or worksheets used during the tape presentation and describe their appropriateness (e.g., very good, adequate, distracting, inappropriate, unnecessary).

How long did it take your class to complete the tape presentation?

What do you think is the minimum amount of time in which the tape presentation could be completed?

What do you think is the maximum amount of time it could take to complete the tape presentation?

Post-Activities

(General Comments):

	<u>Yes</u>	<u>No</u>	<u>Unsure</u>
In general, did you feel that the post-activities strengthened the concepts developed in the tape presentation?	()	()	()
Were the post-activities sufficiently explained so that you could direct them without difficulty?	()	()	()
Were the post-activities sequenced in the best way? (If not, how would you sequence them?)	()	()	()

Are there any other activities that you feel should be included in the post-activities?

(Specific Comments): A number of post-activities were suggested to you. Please list each activity you used by kind (Required or Optional) and number, and give your opinion of the activity and how you think it might be strengthened (include, if possible, the amount of time spent on each activity). It is important that we get your specific comments on every activity that you have used. Feel free to use as much paper as necessary.

General Comments on the Lesson

Please look at the page in your Teacher's Manual which shows the vocabulary words for the unit (page ii). Note the position of this lesson within the unit.

	<u>Yes</u>	<u>No</u>	<u>Unsure</u>
Does this chart help you to understand the place of this lesson in the whole sequence of the unit?	()	()	()
Do you feel that the children in your class are now educationally and motivationally ready for the next lesson in the unit?	()	()	()
At this point, do you agree with the ordering of the lessons?	()	()	()
If not, how would you change the sequence of the lessons (or, is there a lesson not included here that you feel is needed and should be inserted before this lesson?).			

Look at the purpose and behavioral objectives for the lesson. Did the activities and tape presentation of the lesson meet these objectives?

How many children did you feel knew the vocabulary concepts at the end of the complete lesson (tape and activities)?
 () None () Some () Most () All

Did the children enjoy the lesson?

What aspect of the lesson was most popular?

What aspect of the lesson was least popular?

Are there any changes or additions you would recommend to enhance the children's enjoyment and/or learning without distracting from the lesson?

If you had to pick the one aspect of the lesson which you felt was the most important in insuring that the children learned the concepts presented, what would you select in this lesson?

How much actual time did you spend on this lesson?

Total number of days? _____

Approximate total amount of time? _____

What was your feeling about the length of this lesson?

☐ Too long ☐ Too short ☐ About right

CLASSROOM OBSERVATION FORMS

PRE-PRIMARY LENGTH UNIT OBSERVATION

Observer _____ Date _____ Lesson _____

Teacher _____ School _____

OBJECTIVES OF LESSON _____

NUMBER OF CHILDREN WHO MEET
OBJECTIVE

Lesson _____ Teacher _____

School _____ Date _____

OBJECTIVES OF LESSON _____

NUMBER OF CHILDREN WHO MEET
OBJECTIVE

Fill in the objectives listed in the manual for the particular lesson you are observing. Note the number of children who reach each objective during the lesson.

PRE-PRIMARY LENGTH UNIT OBSERVATION

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Observer _____

Lesson _____ Date _____

Teacher _____ School _____

1. Raises hand

2. Responds to tape or teacher

3. Reaches an objective

4. Daydreaming or any non-task oriented activity

5. Degree of involvement

All of the time
75-100%Most of the time
50-75%Part of the time
25-50%Very little of the
time
25%

Observe 5 children for 5 minutes each. Note the behaviors they exhibit. These are listed 1-5. Across the top fill in the names of the children you observe. In the boxes fill in the number of times each individual engaged in listed behavior.

In the behavior listed Degree of involvement estimate where each of the children you observed falls, place an X in the corresponding box.

Teacher _____ Unit & Lesson _____
Date _____ Observer _____ School _____

1. Attention of students: How many respond?
2. How many respond to tape?
3. How many respond to the teacher?
4. Is there more group or individual response?
5. Are the same or various people responding?
6. Does the teacher stop tape to review or further explain? Does the tape need further explanation and why?
7. Is the tape clear?
8. Do teacher and students seem enthusiastic?
9. Does the teacher add anything to the lesson which is not in the curriculum? If so note the items which the students responded well to. Respond on back.
10. How does an observer affect the class?
11. Demographic arrangement of the room:
 - a. Children at desks scattered around the room
 - b. Children at desks in two's, three's etc.
 - c. Children at large table
 - d. Children on chairs in group around teacher
 - e. Children on floor
 - f. other

Appendix 5

A DESCRIPTION OF THE REVISED VERSION OF THE
MEASUREMENT OF LENGTH UNIT

The Measurement of Length Unit consists of three books of instruction to be used sequentially. The books develop measurement concepts by beginning with lessons on the comparatives of distance, height, and length. Instruction then progresses to the recognition of the common tools and units of measurement, and finally to the development of measurement skills. The major focus of each book, along with a summary of the lessons, is provided below:

Book One

Book One of the Measurement of Length Unit presents the comparatives of distance, height, and length. The processes of identification, demonstration, and utilization are stressed in the instruction. There are 12 lessons in Book One.

The book is organized so that the comparatives of distance are presented first, the comparatives of height next, and the comparatives of length last. Instruction on each set of comparatives proceeds from identification and demonstration of instances of each comparative term to the utilization of all comparative terms within a single context. A lesson of review activities follows each set of comparatives to promote the utilization of the comparatives by the children.

Lesson 1: "Far and Near"

Vocabulary Words: FAR, NEAR, CLOSE

The children are introduced to the basic comparatives of distance - far and near (with close introduced as a synonym of near).

Lesson 2: "Closer and Closest"

Vocabulary Words: CLOSER, CLOSEST

The children are taught to identify and demonstrate instances of the concepts "closer" and "closest".

Lesson 3: "Farther and Farthest"

Vocabulary Words: FARTHER, FARTHEST

The children are taught the concepts "farther" and "farthest". Emphasis is placed on the behavioral objectives of identification and demonstration.

Lesson 4: "Review of Distance Comparatives"

Vocabulary Words: CLOSER, CLOSEST, SAME
(as close as), FARTHER, FARTHEST

The children are provided with a general review of the distance comparatives by being introduced to their use in situations where both closer (closest) and farther (farthest) comparisons are made in a single context. Stress is placed on the behavioral objective of utilization. In addition, the concept of the same distance (as close as) is introduced.

Lesson 5: "Tall and Short"

Vocabulary Words: TALL, SHORT

The children are taught to identify and demonstrate instances of the concepts "tall" and "short".

Lesson 6: "Taller and Tallest"

Vocabulary Words: TALLER, TALLEST

The children are taught the comparatives "taller" and "tallest". Emphasis is placed on the behavioral objectives of identification and demonstration.

Lesson 7: "Short"

Vocabulary Words: SHORTER, SHORTEST

The children are taught the comparatives "shorter" and "shortest", with emphasis being placed on identification and demonstration of the concepts.

Lesson 8: "Review of Height Comparatives"

Vocabulary Words: TALLER, TALLEST, SAME
(as tall as), SHORTER, SHORTEST

The children are provided with a review of the height comparatives from Lessons 5 through 7. Through activities, the children are familiarized with the utilization of all comparatives in one context. In addition, the concept of the same height (as tall as) is introduced.

Lesson 9: "Long and Short"

Vocabulary Words: LONG, SHORT

The children are taught identification and demonstration of the comparatives "long" and "short".

Lesson 10: "Mr. Long"

Vocabulary Words: LONGER, SHORTER

The children are taught the comparatives "longer" and "shorter". Emphasis is placed on the behavioral objectives of identification and demonstration.

Lesson 11: "Shorter and Shortest"

Vocabulary Words: SHORTER, SHORTEST

The children are taught the comparatives "shorter" and "shortest" in relation to length. Emphasis is placed on identification and demonstration of the comparatives.

Lesson 12: "Review of Length Comparatives"

Vocabulary Words: LONGER, LONGEST, SAME (as long as), SHORTER, SHORTEST

The children are provided with a review of the length comparatives from Lessons 9 through 11. Again, through activities the children are familiarized with the utilization of all comparatives of length in one context. In addition, the concept of the same length (as long as) is introduced.

Book Two

Book Two in the Measurement of Length Unit is concerned with concepts related to beginning measurement skills. It deals with the vocabulary and skills involved in measuring to the nearest foot. There are six lessons in Book Two.

The book begins by presenting general concepts related to measurement (e.g., "measure," "measuring tool") and by familiarizing the children with several common tools of measurement. Then, through the introduction of the "foot" unit, the children are taught how to use several measuring tools to measure to the nearest foot.

Lesson 1: "Let's Measure"

Vocabulary Words: MEASURE, HOW LONG, HOW TALL,
HOW FAR AWAY

The children are introduced to the the word "measure" and the three dimensions of measuring (length, height, and distance), as they are shown why measurement is so important.

Lesson 2: "Measuring Tools"

Vocabulary Words: MEASURING TOOL, RULER
YARDSTICK, TAPE MEASURE

The children are introduced to the concept of a "measuring tool" and taught to identify and label the most commonly used measuring tools. In addition, development of the concept of a standard for use in measurement is begun.

Lesson 3: "How Long Is It?"

Vocabulary Words: FOOT RULER, FOOT

The children are introduced to the most familiar measuring tool (foot ruler) and unit (foot) for measuring length.

Lesson 4: "Feet"

Vocabulary Word: FEET

The children are introduced to a common term of measurement (feet) and taught how to measure in exact feet using a foot ruler.

Lesson 5: "Measuring Feet with a Foot Ruler"

Vocabulary Words: LONGER THAN, SHORTER THAN,
(almost)

The children are provided with practice in measuring objects in feet.

Lesson 6: "Measuring with a Yardstick"

Vocabulary Words: YARDSTICK, YARD

The children are taught the relations between the lengths of a yardstick and a foot ruler. In addition, they are taught how to measure in feet using a ruler.

At the end of Book Two, a Review activity summarizes and relates all the concepts present in the Book. This provides an efficient way to evaluate the children's understanding of these important beginning measurement concepts.

Book Three

Book Three in the Measurement of Length Unit is concerned with the further development of vocabulary and skills related to measurement. There are five lessons in Book Three.

Lesson 1: "An Inch"

Vocabulary Word: INCH

The children are taught a third standard for measuring length - the inch.

Lesson 2: "Inches"

Vocabulary Words: INCHES, LONGER THAN,
SHORTER THAN (almost)

The children are introduced to the plural inches and taught how to use a foot ruler to measure objects in inches.

Lesson 3: "Measuring Inches with other Tools"

Vocabulary Words: INCHES, RULER, YARDSTICK
TAPE MEASURE

The children are taught to identify inches on a yardstick and a tape measure, as well as how to measure in inches using these tools.

Lesson 4: "Length, Height, Distance"

Vocabulary Words: LENGTH, HEIGHT, DISTANCE

The children are taught, in two tape presentation, the labels "length," "height," and "distance" for the concepts "how long", "how tall", and "how far away".

Lesson 5: "Feet and Inches"

Vocabulary Words: FEET AND INCHES

The children are introduced to the use of the phrase "feet and inches" as well as the skills involved in measuring accurately in feet and inches.

Appendix 6

REVISED LENGTH UNIT TESTS

The revised Length Unit tests included a Skills Test and an Expressive Vocabulary Test. The Length Skills Test was an 11 item test designed to evaluate the child's skills related to the measurement of length. The test consisted of three subtests, each of which evaluated a specific skill area: 1)Comparatives, 2) Pre-requisites to measuring, and 3) Measurement. The Length Expressive Vocabulary Test was a 13 item test designed primarily to assess the child's ability to utilize specific vocabulary words. This test consisted of three subtests which corresponded to the three instructional books in the revised Measurement of Length Unit. Both tests were designed to be individually administered.

SKILLS TEST

Length Unit

SUBTEST #1: COMPARATIVESIdentification 1 (longest)

DO: Show student picture "AA."

SAY: Look carefully at all the pencils on this page. Find the longest pencil and point to it.

PROMPT: Show me the picture of the longest pencil.

Scoring: If student includes any incorrect choices, score a NO.

Identification 2 (farthest)

DO: Show picture "BB".

SAY: Look at the boy in this picture (point to the boy). Now look at the snowmen. I want you to point to the snowman that's standing the farthest from the boy. Which snowman is farthest from the boy?

PROMPT: If student seems confused repeat: Show me the snowman farthest from the boy.

Scoring: For an acceptable response, the student must select only the snowman on the farthest right of the page.

Identification 3 (taller than)

DO: Show picture "BB" again.

SAY: Let's look at this same picture again but I have a new question for you. Some of the snowmen in the picture are even taller than the boy. Look at each snowman and point to the ones that are taller than the boy.

PROMPT: If student seems confused, repeat: Point to the snowmen that are taller than the boy.

The first time the student hesitates in pointing, say: "Are there any more snowmen that are taller than the boy?" Say this once (and only once) to every student, even if it is not asked until after the child has found both of the taller snowmen.

Scoring: For an acceptable response, the student must select only the 2 taller snowmen.

Length Unit

Demonstration 4 (shorter than)

DO: Prepare a row of blocks
5 units long.
Place in front of student
7 "extra" blocks.

SAY: I'm going to put some blocks
together (prepare row of 5 blocks).
Now here are some blocks for you
to use (indicate group of 7 blocks).
Make a row of blocks shorter than
mine (lay row of 5 blocks on
table).

PROMPT: If student seems confused,
repeat: Build your row shorter
than mine.

If student does not place any
blocks together but indicates one
block as the row, ASK: which
one is shorter?*

Scoring: Acceptable responding includes a row between one to five blocks
long.

*When indicating a row one block long, the student must point to
his row as being shorter in order to be scored a YES.

Orders 5 (shortest to longest)

DO: Place set of pictures of 5
bats on table in random order.

SAY: Now I want you to put these
5 bats in order from the shortest
to the longest.

PROMPT: Put the shortest bat here
(demonstrate) and put the other
bats in a row from the shortest to
the longest.

Scoring: For an acceptable response, the student is required to
correctly order the bats according to increasing length.

SKILLS TEST

Length Unit

Identification 6 (as close as)

DO: Show picture "CC".
Place on table so the
ball is closest to the
student.

SAY: Look very carefully at this picture. Point to the ball. And there's a giraffe, a seal, a lion and an elephant (point to each animal). See how close the seal is to the ball (draw imaginary line between seal and ball) Now which other animal is as close to the ball as the seal is?

PROMPT: If student seems confused, repeat: Show me the one animal that is as close to the ball as the seal is.

Scoring: For an acceptable response, the student must only select the picture of the elephant.

Length Unit.

SUBTEST #2: PREREQUISITES TO MEASURING

Identification 1 (Measuring tools)

DO: Show picture "DD".

SAY: Look at all the pictures carefully. Point to all the pictures of the measuring tools.

PROMPT: If necessary repeat the question.

The first time the student hesitates in pointing, SAY: "Are there anymore measuring tools?" Say this once (and only once) to every student, even if it is not asked until after the child has pointed to both measuring tools.

Scoring: If student includes any incorrect choices, score a NO.

Demonstration 2 (how far)

DO: Place a red block and a blue block on the floor, approximately 2 feet apart.

SAY: Now use this ruler to find out how far away the red block is from the blue block. (Tell child he can get on the floor).

PROMPT: If necessary, repeat the question or SAY: "Show me what you'd do to find out how far away the red block is from the blue block."

Scoring: For an acceptable response, the student must place the ruler at one end (blue or red block) and have the ruler pointing in the right direction. The student doesn't have to move the ruler. Also, the student is not required to state a measurement ("they are 2 feet apart"). If this is done, simply reinforce the response.

Demonstrating the correct orientation is what is necessary to score a YES.

Demonstration 3 (inch)

DO: Remove foot ruler.

SAY: Show me about how long one inch is.

PROMPT: If necessary, repeat question or How long is one inch?

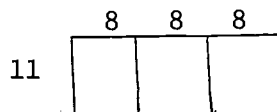
Scoring: Accept responses that are close to one inch long (1/2" to 2").

SKILLS TEST

Length Unit

SUBTEST #3: MEASUREMENTMeasurement 1 (feet)

DO: Place on table:
 1 foot ruler
 3 sheets of $8\frac{1}{2} \times 11$ "
 paper tapes together



(approximate length to be
 measured = 2 feet)

SAY: Now use the ruler to find
 out how long this paper is and
 tell me how long the paper is.
 (indicate side that's 2 feet long)

PROMPT: If necessary repeat
 question.

Scoring: For an acceptable response, the student must measure the
 length of the paper and give an answer in approximate feet (i.e., 2 feet).

Measurement 2 (inches)

DO: Place on table:
 1 foot ruler
 1 sheet of paper 11 inches
 long (use a test picture)

SAY: Use this ruler to find out
 how long this piece of paper is.
 Tell me how long it is. (Indicate
 side that is 11 inches long.)

PROMPT: If student responds
 with "foot", "almost a foot" or
 shorter than a foot" ASK: You're
 right is is (almost a foot),
 Now tell me exactly how long it is
 If student says "11", Ask:
 11 what?

Scoring: For an acceptable response, the student must state 11 inches.

EXPRESSIVE VOCABULARY TEST

Length Unit

BOOK ONE SUBTEST

1. Far

DO: Show picture "EE".

SAY: See, this dog is sitting next to the dog house (point to appropriate dog) - he is sitting near the dog house. Where is this dog sitting (point to the dog in the upper left hand corner).

PROMPT: If student gives a relevant response (i.e., up in the corner) ASK: Right, is he near the dog house? No, if he is not near, where is he?

Scoring: For an acceptable response, the student must state far.

2. Shorter

DO: Show picture "FF".
Place on table so the red pencil is closest to the student.

SAY: How is the red pencil different from the blue pencil?

PROMPT: Is the red pencil longer than the blue pencil? ("no")
What is it?

Scoring: For an acceptable response, the student must use the word shorter in an appropriate context (e.g., "my pencil is shorter than yours," "the red pencil is shorter than the blue pencil").

3. Tallest

DO: Show picture "GG".

SAY: These kids are lined up because of how tall they are.
(Point to tallest child.) Why is this boy standing here?

PROMPT: If student seems confused, repeat: Why do you think this boy is standing at this end of the line?
If student responds "He's taller than everyone else", ASK: Right, he's taller but out of all of those kids, what is he?

If student responds "He's tall" or "He's bigger," ASK: What's another word for tall (bigger)?

Scoring: For an acceptable response, the student must use the word tallest in an appropriate context (e.g., "he's the tallest").

EXPRESSIVE VOCABULARY TEST

Length Unit

BOOK TWO SUBTEST

1. Ruler

DO: Show a primary ruler (12 inches).
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SAY: What's this?	PROMPT: What do you think this is called?
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Scoring: For an acceptable response, the student must state ruler. (Responses, such as "a foot ruler" "12 inch ruler, are even more accurate, and if this type of response is given, a large plus (+) should be put on the scoresheet for this item as well as <u>YES</u> .)

2. Foot

DO: Hold up a foot ruler.

SAY: How long is this ruler?	PROMPT: If response is "twelve," ASK: twelve what? When response is "12 inches; ASK: What's the same as 12 inches?
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Scoring: For an acceptable response, the student must state <u>foot</u> .

EXPRESSIVE VOCABULARY TEST

Length Unit

3. Measuring

DO: Show picture

SAY: All of these tools can be used for the same thing. What are they used for?

PROMPT: If necessary repeat: what are all these tools used for?
If student responds "find out how long something is" ASK: Right, and what do you do to find out...?

Scoring: For an acceptable response, the student must state measure or measuring. If the student adds a context, such as "measuring length," score a $\frac{1}{2}$ as well as YES.

4. Measuring tools (description)

DO: Show picture "HH" again.
Show picture "II".

SAY: Why do we have to use these special tools to measure things. Why couldn't we use something like this (show picture JJ) to measure things?

Scoring: Record all responses on score sheet. (The acceptability level of the responses will be determined at a later date.)

5. Yard

DO NOT use any props.

SAY: (Hold hands about 3 feet apart) I'm holding my hands 3 feet apart -- What's another way of saying 3 feet?

PROMPT: If necessary repeat: what's the same as 3 feet.

Scoring: For acceptable response, the student must state yard.

EXPRESSIVE VOCABULARY TEST

Length Unit

BOOK THREE SUBTEST

1. Inches

DO: Show picture "JJ".

SAY: Look carefully at the picture of this ruler. How long is it?

PROMPT: Look carefully at the numbers and tell me how long it is?

Scoring: For an acceptable response, the student must state inches, and he is correct even if he does not state the correct number (6) of inches.

2. Height/Tall (description)

DO: Hand student a foot ruler.

SAY: If you want to know a person's height, tell me what you use the ruler to find out?

PROMPT: What do you find out when you measure somebody's height?

Scoring: Record all responses on score sheet. For transferring scores to summary sheet, score responses acceptable if they showed that the student understood the orientation of height (e.g., how tall, how high).

3. Length

DO: Use a foot ruler and follow the directions indicated in the question.

SAY: I want to find out how tall and how long this table is. First I'll measure the height of the table (demonstrate measuring, then begin measuring length and ASK:) Now, what am I measuring?

PROMPT: If student responds "how long the table is" SAY: Right, but what's another word for "how long something is"?

Scoring: For an acceptable response, the student must state length.

EXPRESSIVE VOCABULARY TEST

Length Unit

4. Longer than

DO: Place on table in front of student:

foot ruler

card: 14 inches long

(keep out for next question)

SAY: (Place card with ruler on it in front of student)

This isn't exactly a foot long. Is it shorter than a foot? (No) Then what is it?

PROMPT: If student says "almost a foot" ASK: Right, can you tell me more?

Scoring: Correct response is "longer than a foot." Conceptual variations of this would also be correct, however, the word "longer" must be included.

5. Foot and Inches

DO: Keep on table in front of child:

foot ruler

card 14 inches long

SAY: Now, use the ruler to find out exactly how long this card is.

PROMPT: If necessary repeat:
Tell me exactly how long the card is. If student answers "14 inches" ASK: Right, can you think of one more way to tell me how long the card is. How many feet is it?

Scoring: Student is correct only if he responds with phrase "foot and inches," even if he gives incorrect number (2) of inches.

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